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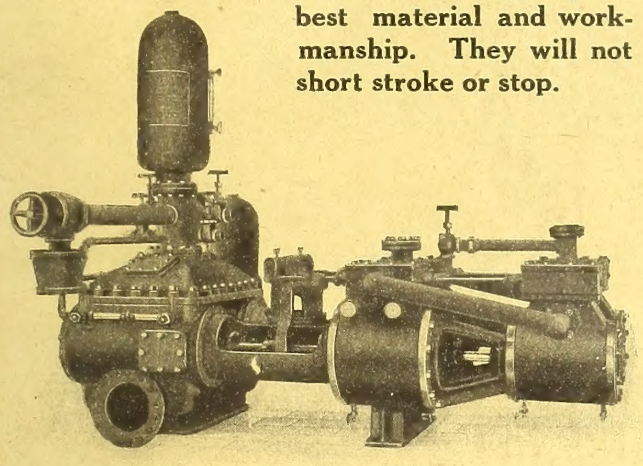
ESTABLISHED 1886

Contract Record and Engineering Review



We manufacture all kinds of Steam and Power Pumps for all kinds of services, using only the best material and workmanship. They will not short stroke or stop.

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HAMILTON, CANADA LTD.

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
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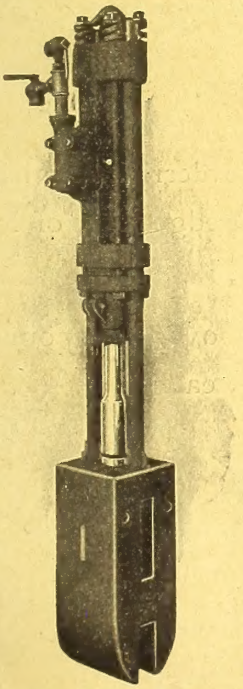

INGERSOLL-RAND
SHEET PILE DRIVERS
FOR WOOD OR STEEL
SHEET PILES

This machine is comparatively light but does the work of a much heavier type owing to the careful distribution of the weight involved.

Canadian Ingersoll-Rand Co., Limited
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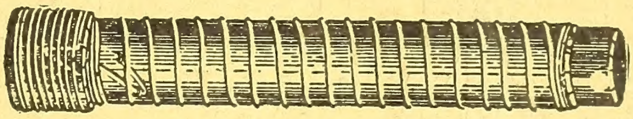

Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6

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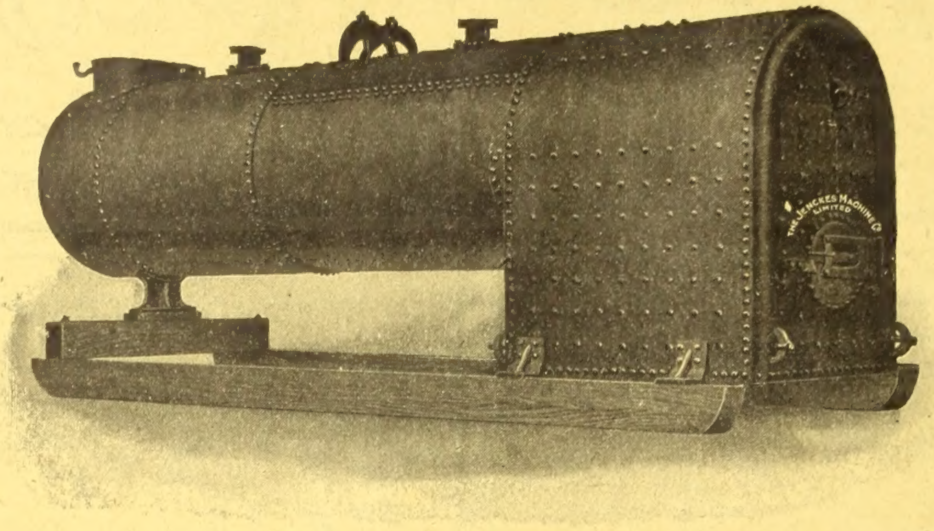
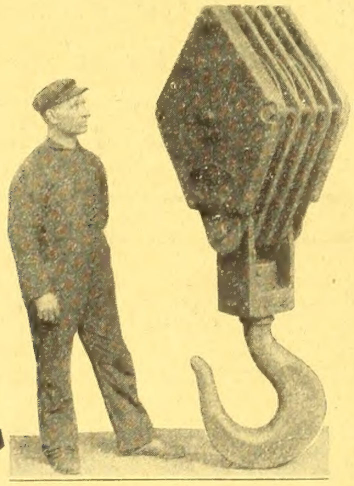
Portable and Stationary Locomotive Boilers for every phase of contracting work.



THE JENCKES MACHINE COMPANY, LIMITED
Sherbrooke Montreal Toronto St. Catharines Cobalt South Porcupine Nelson Vancouver



This
"AMERICAN"
Quadruple Block
Will Lift 50 Tons.

It was made for a huge steel barge derrick furnished to the C. H. Starke Dock and Dredge Co., of Milwaukee.

It has four 24-inch sheaves and the forged steel hook alone weighs over 500 pounds. The steel plates are one inch thick and the cheeks weigh 350 pounds each.

AMERICAN HOIST & DERRICK CO.
St. Paul, Minn., U.S.A.

General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Co., Vancouver, B.C.
Gorman, Clancey & Grindley, Edmonton and Calgary, Alta., and Nelson, B.C.

CANADA Portland CEMENT

SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
PORTLAND
CANADA
CEMENT
MONTREAL

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

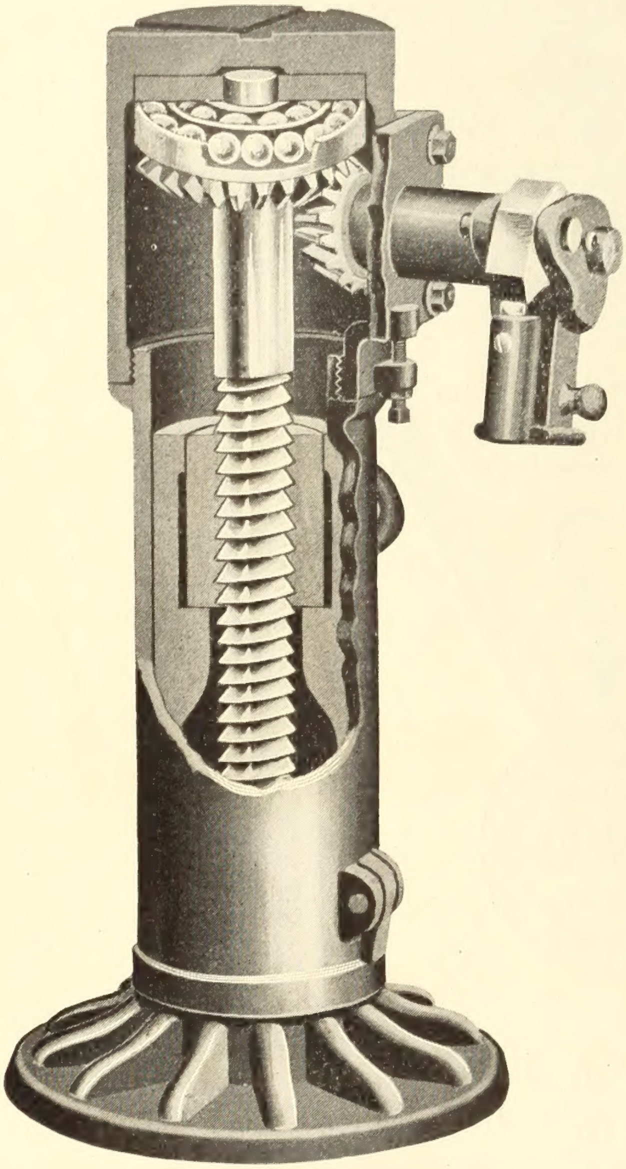
Canada Cement Company, Limited

Head Office - Montreal

Sales offices at

Montreal - Toronto - Calgary - Winnipeg

Absolute Safety



under all conditions is insured if you use the

NORTON
BALL-BEARING
JACK

It holds the load positively, and may be left standing under the heaviest load with perfect safety.

The Norton Jack is the kind that can be depended upon in an emergency.

It Is Always Ready For Use

Montreal, 318 St. James St.
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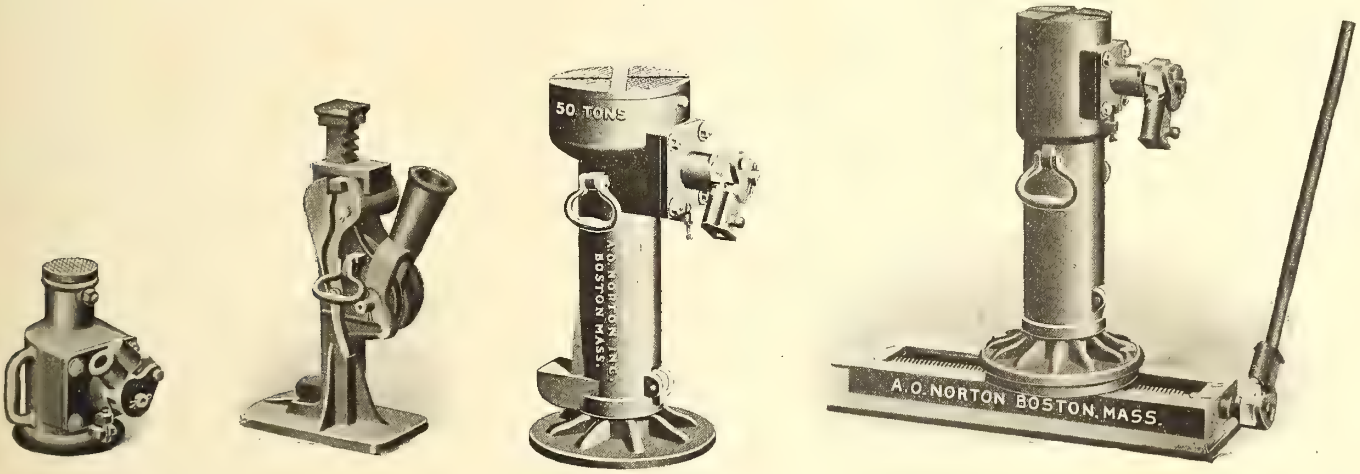
MUSSENS

NORTON HIGH SPEED JACKS

Will lift and lower their full-rated capacity four times as fast as any other Ball-Bearing Jack of equal capacity.



Jacks for all purposes carried in stock. Capacities up to 100 tons.

Ask for Catalogue No. 26

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Halifax, 78 Granville St.

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Canada Wire & Iron Goods Co.
Dennis Wire & Iron Works.
Dom. Ornamental Iron Works.
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Meadows Co., Geo. B.
Steel & Radiation Ltd.

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Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

(Continued on page 12)

BANK OF OTTAWA, BROADVIEW AND GERRARD, TORONTO

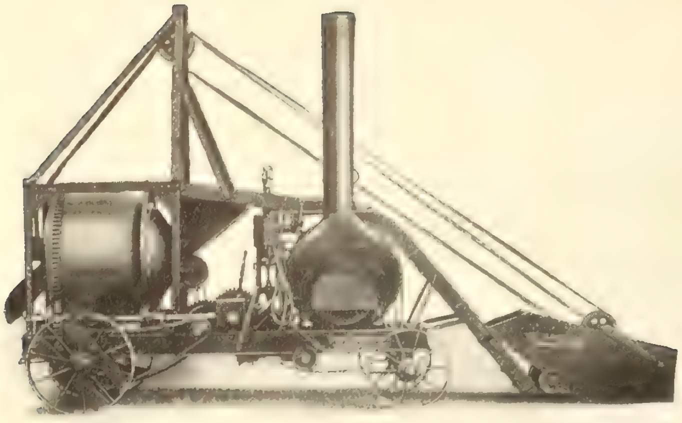
DON Valley Clay Products are found in fine residences, handsome office buildings, imposing banks, stately public buildings and even the aristocratic little bungalow is often constructed of these excellent products.

Don Valley Bricks have the beauty of appearance that is so necessary a factor in present day construction.

Specify "Don Valley Clay Products"

Don Valley Brick Works

Toronto, Ont.



A Wettlaufer Mixer

The Pinnacle of Perfection

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont., Buffalo, N. Y., Detroit, Mich.

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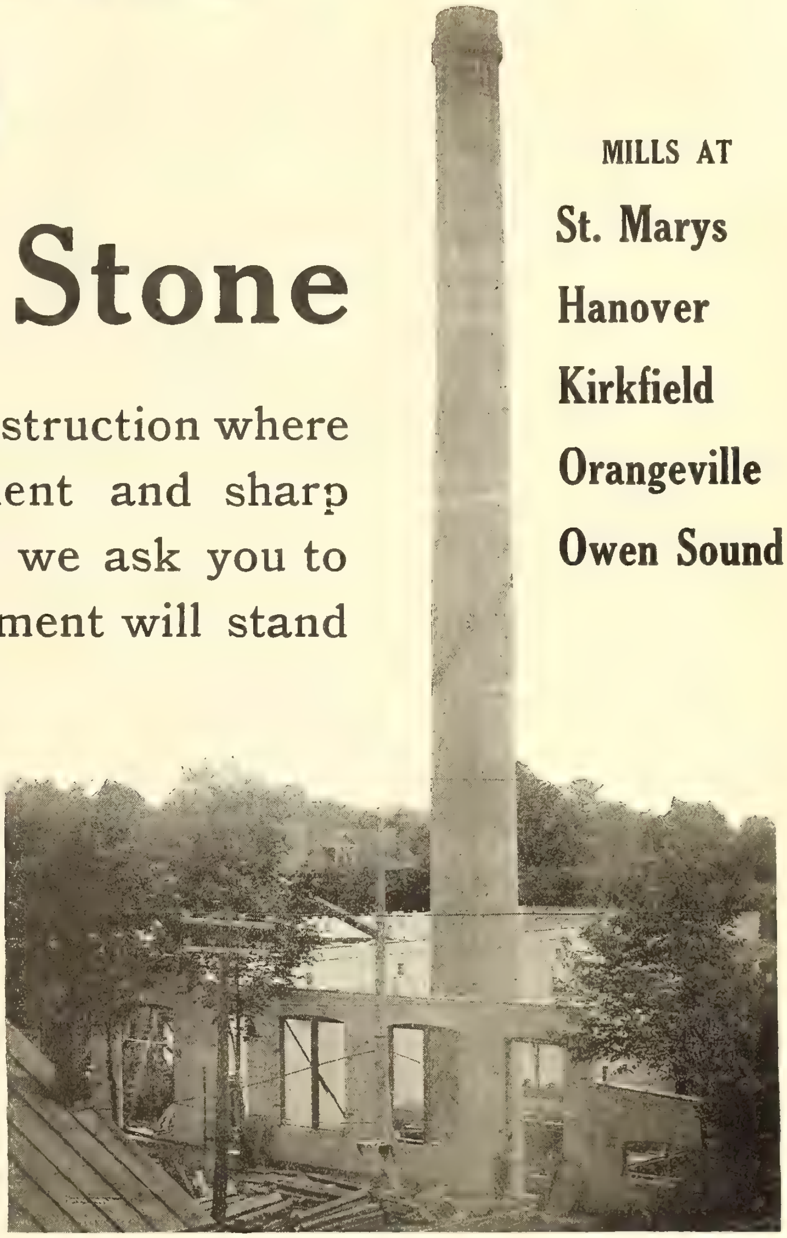
Cement
and
Crushed Stone

For difficult concrete construction where the highest quality cement and sharp clean stone are required we ask you to specify Rogers'. Our cement will stand all your tests.

MILLS AT

St. Marys
Hanover
Kirkfield
Orangeville
Owen Sound



125' x 5' reinforced concrete chimney. Built for the Dominion Canners Co., Limited, by The Weber Chimney Co., Chicago.

Rogers' Cement used.

Alfred Rogers
Limited
28 King Street West
Toronto

QUARRIES AT

Vinemount
Dundas

The Polygon Mix

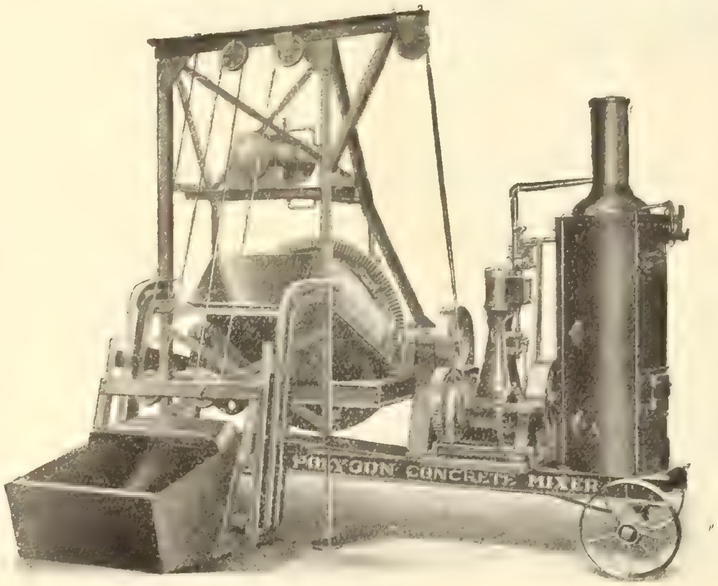
Is The Fastest Perfect Mix

The more perfect the mix, the better the completed job. The more rapidly the work is done, the more money in it. Speedy equipment is necessary to meet all competition with a sure margin of profit.

The POLYGON is the summit of achievement in Concrete Mixers. It will do all that any other mixer will do, and do it better and faster.

Polygon Tilting Drum Concrete Mixer with Power Loader.

Furnished with Steam, Gasoline or Electric Power.

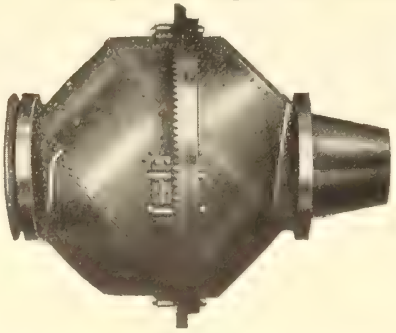


Built in Capacities of 6, 7½, 15, 26, 33, and 50 cubic feet of unmixed material per batch.

Ten Years of steadily growing popularity.

Look at the Polygon Drum

and you will discover the reason for reputation of "The Fastest Perfect Mixer." The POLYGON takes its name from the form of the drum, which is polygonal, or many sided. This drum is hung at an angle, that when it is revolved, presents to the charge eight different surfaces in constantly changing angles. It is the most rapid and thorough mixing action ever devised. It does not depend upon blades. The material is not merely lifted and dropped but is hurled from one plane or surface to the other. In ten revolutions of the drum, or less than thirty seconds, the batch is thoroughly mixed and easily dumped.



IT WILL PAY YOU TO INVESTIGATE THE POLYGON BEFORE YOU BUY ANY OTHER MIXER

WATERLOO CEMENT MACH'Y CORP'N

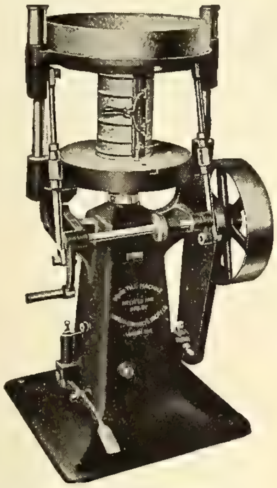
117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists, Elevators and Cement Tools

CANADIAN REPRESENTATIVES:—Waterloo Cement Mach'y Corp'n, 127 Coristine Building, Montreal, Que.; General Mach'y Co., 22 Mulock Ave., Toronto, Ont.; J. W. Anderson, 3 Bank St. Chambers, Ottawa, Ont.; J. A. McTaggart & Co., Winnipeg, Man.; Strumbert, Virtue & Co., 319 Pender St., Vancouver, B.C.

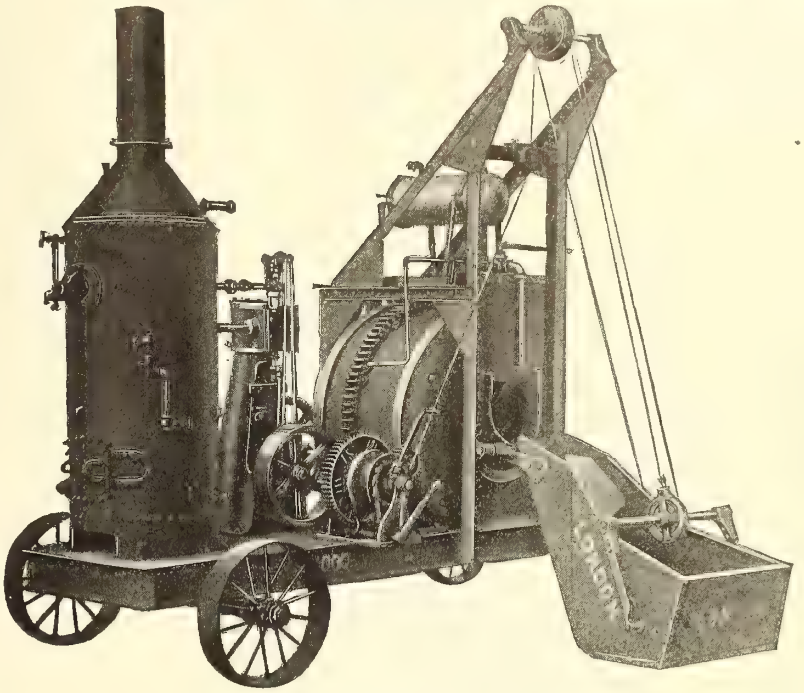
LONDON CONCRETE MACHINERY

Is Not Built Down to a Price, but Up to a Standard.



Dunn Cement Drain Tile Machine

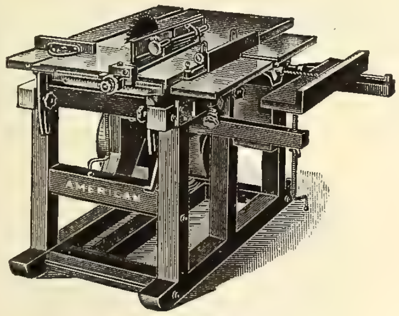
We Cannot Afford to Make anything but the Best.



London Standard Drum Batch Mixer

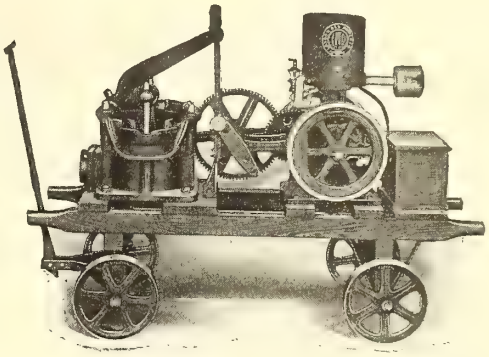
There are Large Profits in the manufacture of Cement Drain Tile.
Write for Particulars.

Over 600 London Concrete Mixers sold in Canada in Three Years.



Variety Woodworker

No Contractor can afford to be without a Variety Woodworker



Diaphram Pump with Power

We manufacture a complete line of Contractors' Machinery: Concrete Mixers, Hoisting Engines, All kinds of Pumps, Block Machines, Brick Machines, Tile Moulds, Derricks, Cars, Ornamental Moulds, Wheel Barrows, Carts, Scrapers and Cement Working Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

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CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (60 Richmond St. E.) F. D. Emsley, Mgr.

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REGINA, H. A. Knight
FORT WILLIAM, Northern Eng. & Supply Co.
MONTREAL, Foss & Hill Mach. Co.
QUEBEC, A. D. Masson

We are the Largest Manufacturers of Concrete Machinery in Canada.

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  - Linde British Refrigeration Co.
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  - Standard Underground Cable Co. of Canada, Limited
- **Interior Finish and Doors**
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  - Canadian Sirocco Co.
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- **Lime Kilns**
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- **Pipe (Concrete, Iron and Wood)**
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  - Canadian Allis-Chalmers, Ltd.
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  - Piggott & Co., Thos.
  - United States Cast Iron Pipe & Foundry Company
  - Walsh Plate & Structural Works
- **Pile Driving Machinery**
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  - Browning Engineering Co.
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  - Lecky & Collis
- **Pipe Fittings and Flanges**
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- **Planing Mill Exhausters**
  - Canadian Buffalo Forge Co.
  - Sheldons Limited
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- **Plug Drillers**
  - Canadian Ingersoll-Rand Co.
- **Plaster**
  - Alabastine Hardmortar Co.
  - Albert Mfg. Company
  - Britnell & Company
  - Ontario Lime Co., Ltd.
- **Plumbing Supplies**
  - Mueller Mfg. Co., H.
- **Plumbing**
  - Dietrich Limited
- **Pneumatic Machinery**
  - Canadian Ingersoll-Rand Co.
- **Portable Saws**
  - Canadian Fairbanks-Morse Co.
- **Portable Track**
  - Bechtels Limited
- **Power Engines**
  - Inglis Company, John
  - Jenckes Machine Company
  - Canadian Allis-Chalmers, Ltd.
  - Waterous Engine Works
- **Pumps and Pumping Machinery**
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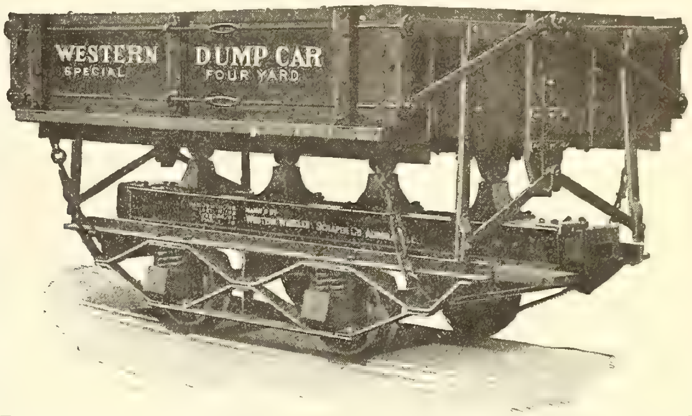

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The Toughest Stone for Macadam in Ontario

Record of Logan Avenue, Toronto, Macadamized from Queen St. to Gerrard St., in 1902
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COST FOR REPAIRS

1903	$ 0.00	1908	$ 93.26
1904	3.30	1909	200.46
1905	9.35	1910	14.07
1906	37.33	1911	2.29
1907	16.11		

Total $376.17 or 5⅔c. per sq. yd. for repairs for nine years, a little over 6-10 of 1c. per sq. yd. per year.

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Hagersville Contracting Co.
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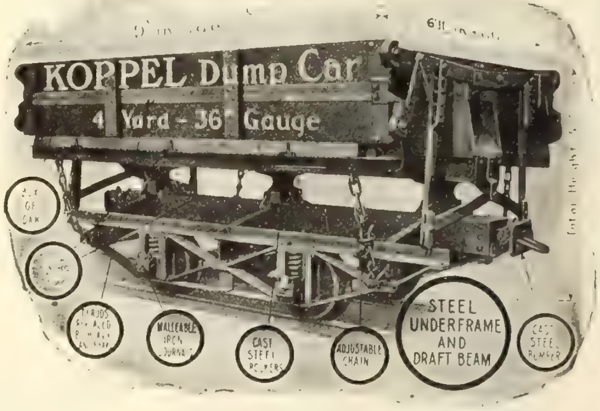
Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

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Preserves Roads
Prevents Dust~

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Dust is Expensive

When an automobile speeds down an ordinary macadam road it leaves in its wake a cloud of dust which is carried by the winds over the neighboring fields, houses and lawns.

This is just as surely a waste of good material as if the automobilist dug material out of the highway and carted it away. Dust represents waste—costly waste—and the taxpayers feel the result. A road that is properly built for modern traffic will not be dusty.

Plain macadam gives way under the wear and tear of heavy rubber-tired automobile wheels and the surface binder of the road is torn away in the form of dust, until in time the coarse stone itself is exposed and a costly renewal of the road is necessary.

Modern roads should be built to resist modern traffic. To build any other kind is wasteful. A better binder than the ordinary mineral binder is needed and is offered in Tarvia, a coal tar compound especially prepared for use on roads.

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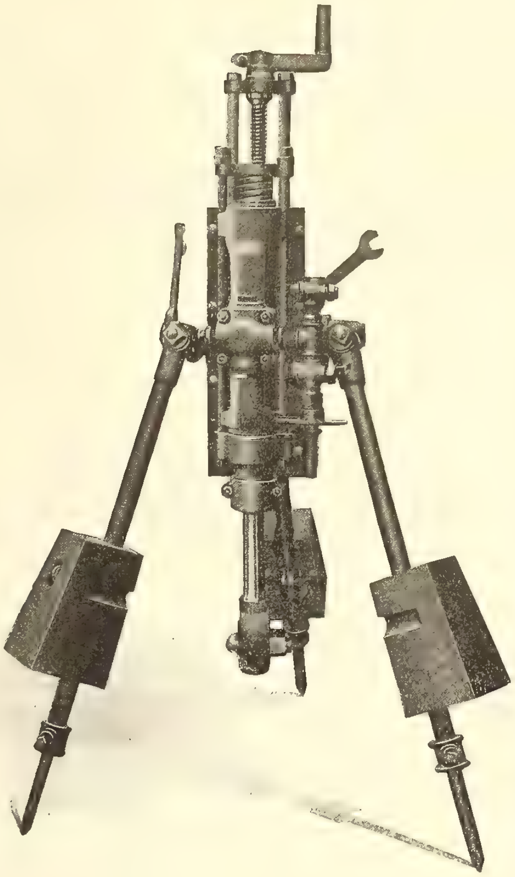

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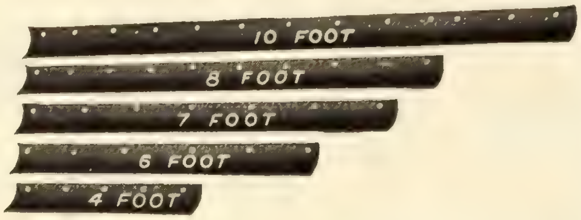

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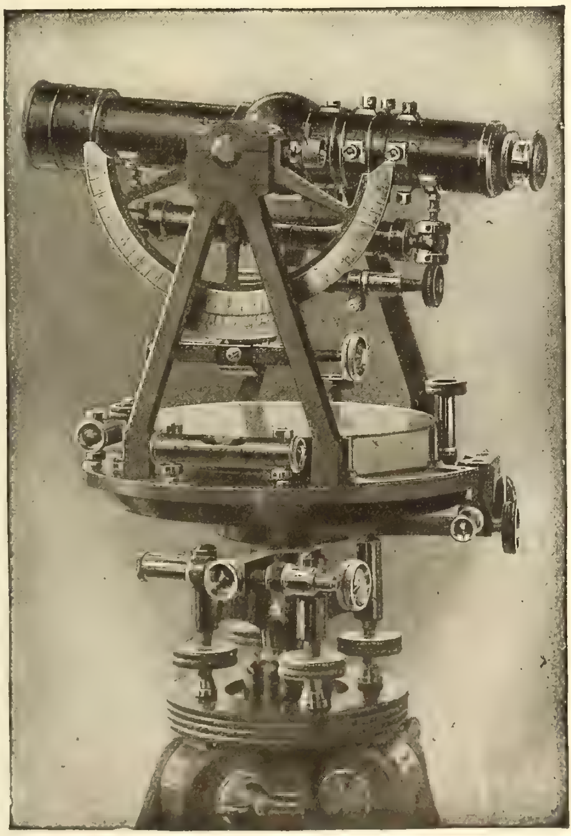

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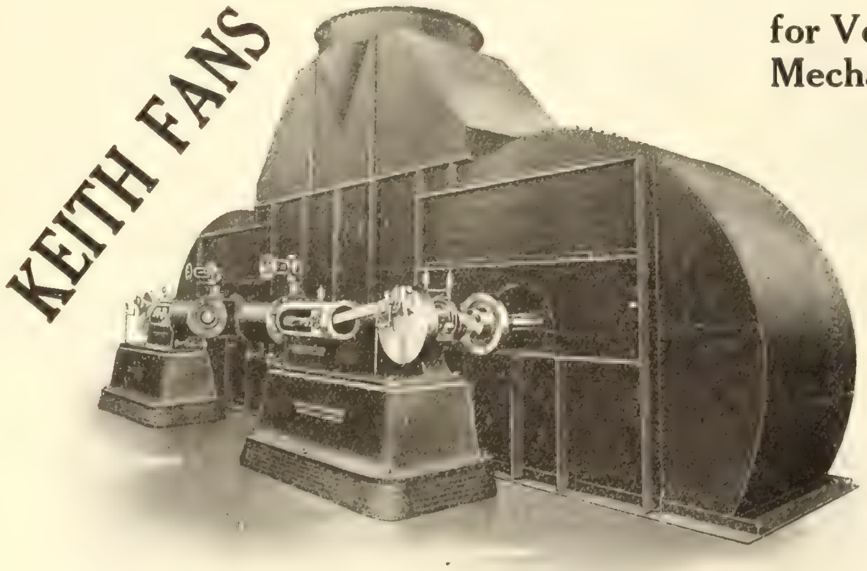

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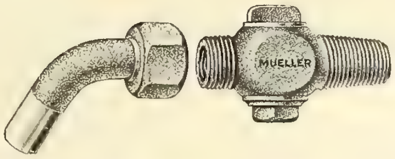
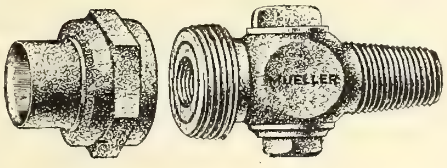
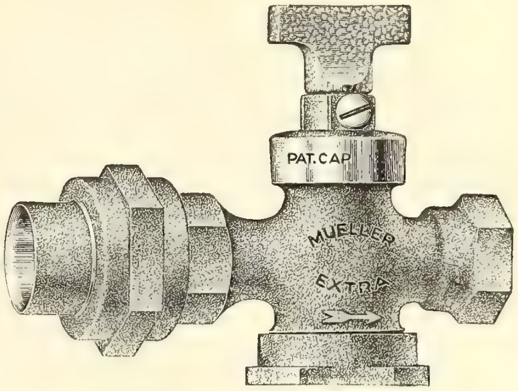


Corporation Cock D—3004



Lead Flange Corp. Cock D—5051



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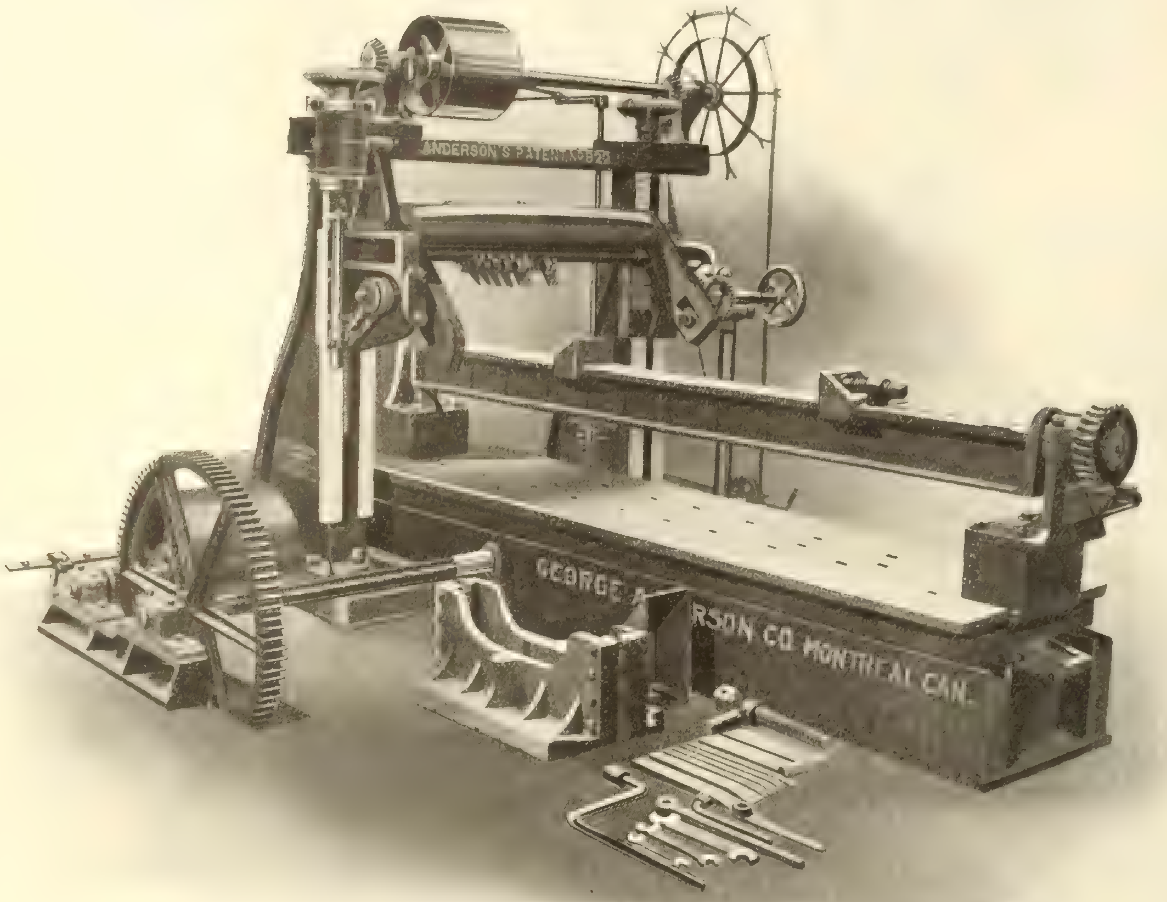

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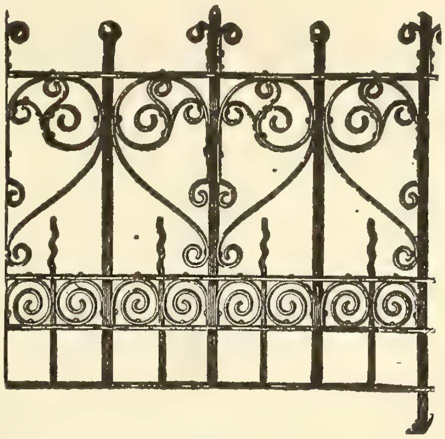

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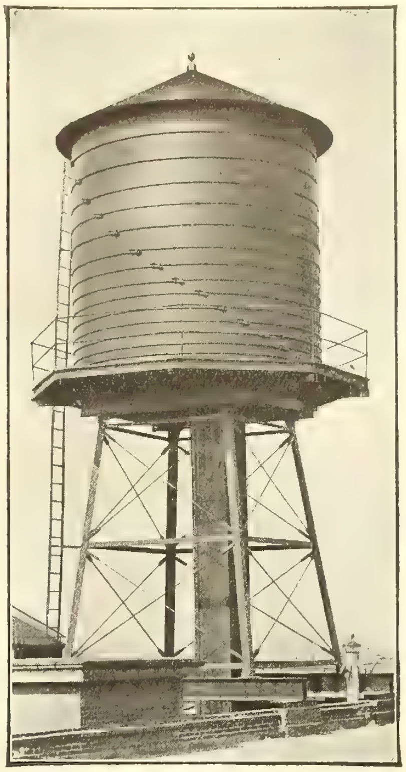

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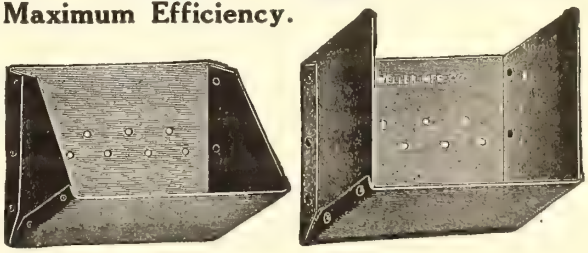

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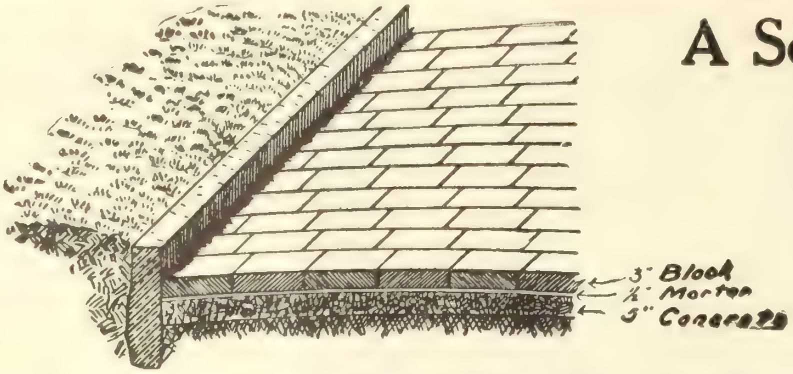

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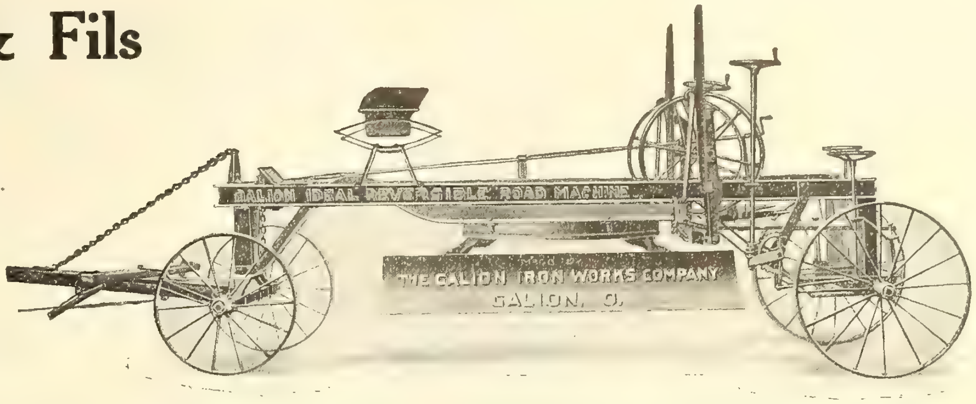
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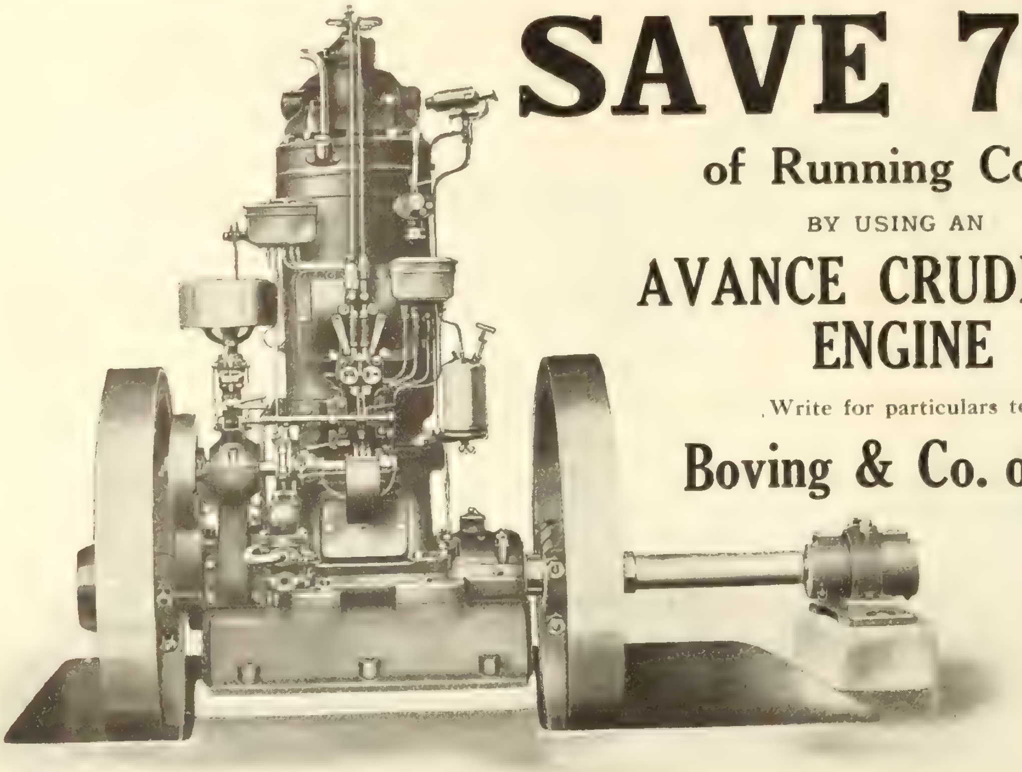

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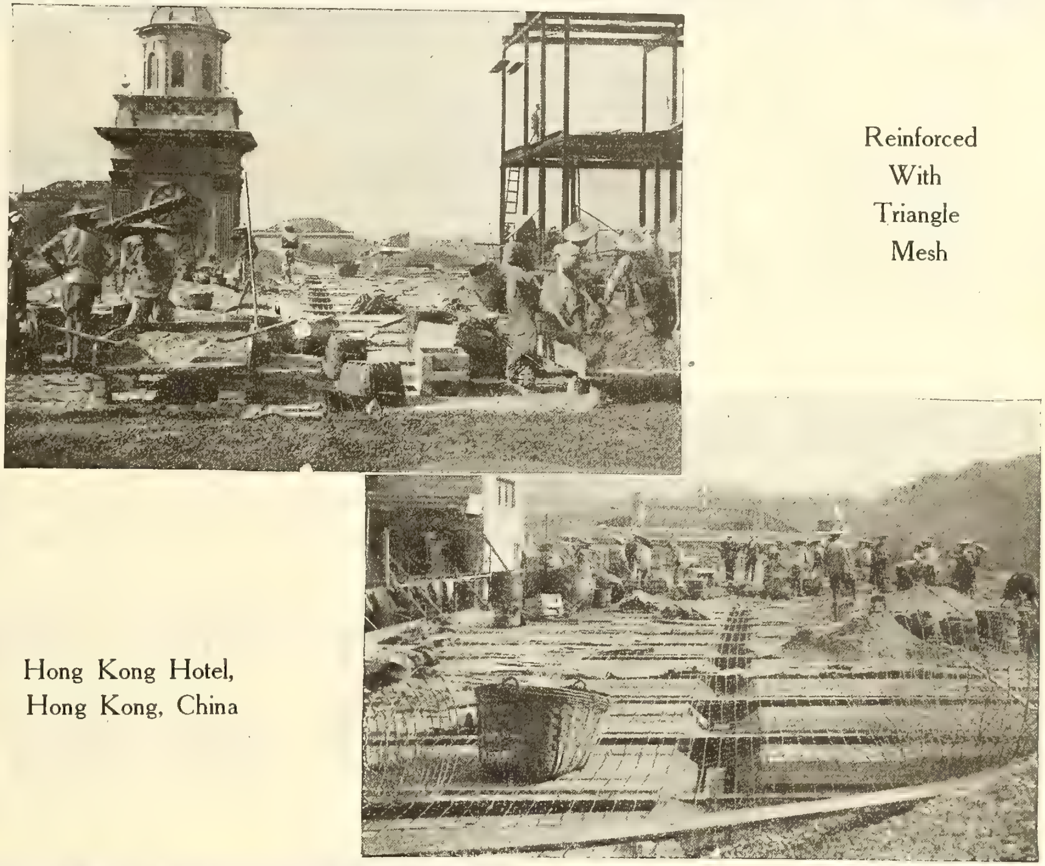

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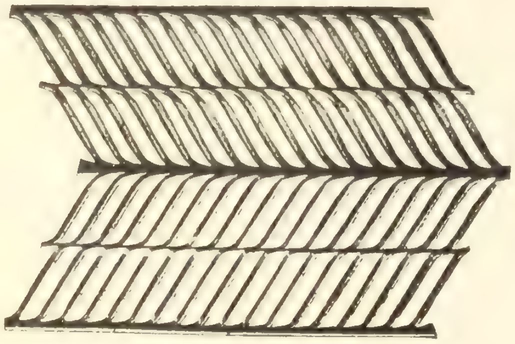

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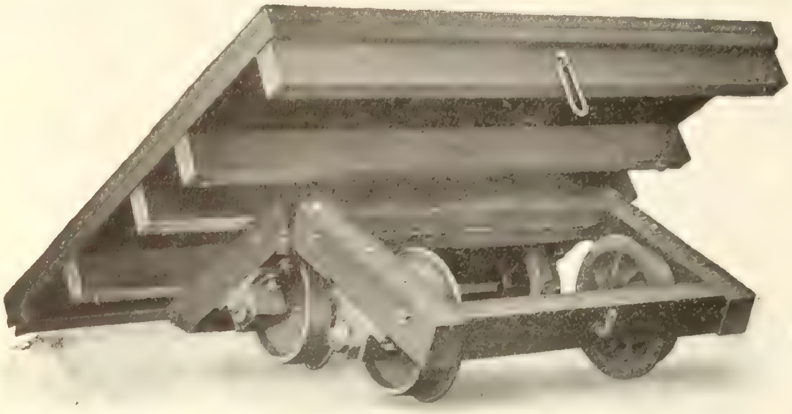

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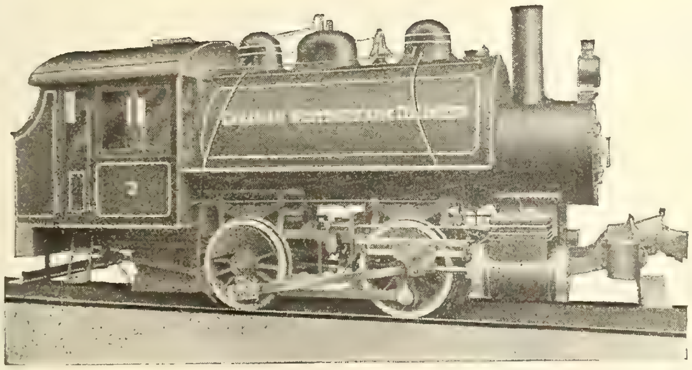

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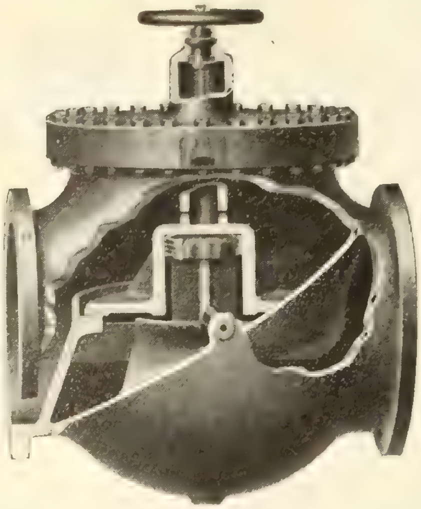

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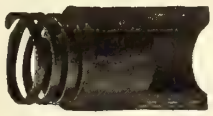
¶ The walls of the hose are composed of long strips of cotton fabric thoroughly impregnated with rubber or friction. And cut on the bias to resist expansion, bursting and elongation. This friction-impregnated fabric is rolled under great pressure, which ensures a perfect union of the plies.



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¶ We build into Goodyear Hose the same strength and indestructibility as have made Goodyear Rubber Belts famous. Goodyear Suction Hose is steel-wound internally to guard against collapse. The coil is of round or flat wire, and round it the hose is built up, ply upon ply of rubber-permeated cotton fabric. This fabric is made from special hard-staple long-fibre cotton, and is cut on the bias to give strength and hard wear.

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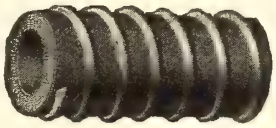

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¶ Steam Hose gets more hard usage than any other hose. In the Boiler Room it lies around near the furnace and is scorched—a hot firing tool is carelessly thrown down upon it—oil is spilt over it.

¶ Goodyear Steam and Hot Water Hose is made with special heat resisting lining, which keeps the extreme heat from the friction fabric. This gives the extra durability—it will stand up well under hard usage. In its manufacture the materials undergo special treatment to resist oil—so destructive to common hose. The rubber and duck used in Goodyear Steam Hose are specially tested for service under high pressure of steam and hot water. We supply it steel wire wound or marline jacketed.

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¶ When Mill Hose is wanted it is wanted badly. To find that your Mill Hose has cracked and rotted while lying idle is serious. **"Goodyear Underwriters"** is always ready for effective service. We build this hose to meet the requirements of the Associated Factory Mutual Fire Insurance Companies. It bears the required stamp of approval "tested to 200 lbs. pressure." The inner tube is made from N E W Rubber of the highest grade, uniform in thickness and quality. The cotton fabric is of special circular web woven to the Underwriters' specifications for a minimum of expansion or elongation under pressure. It is antiseptically protected against rot and mildew.

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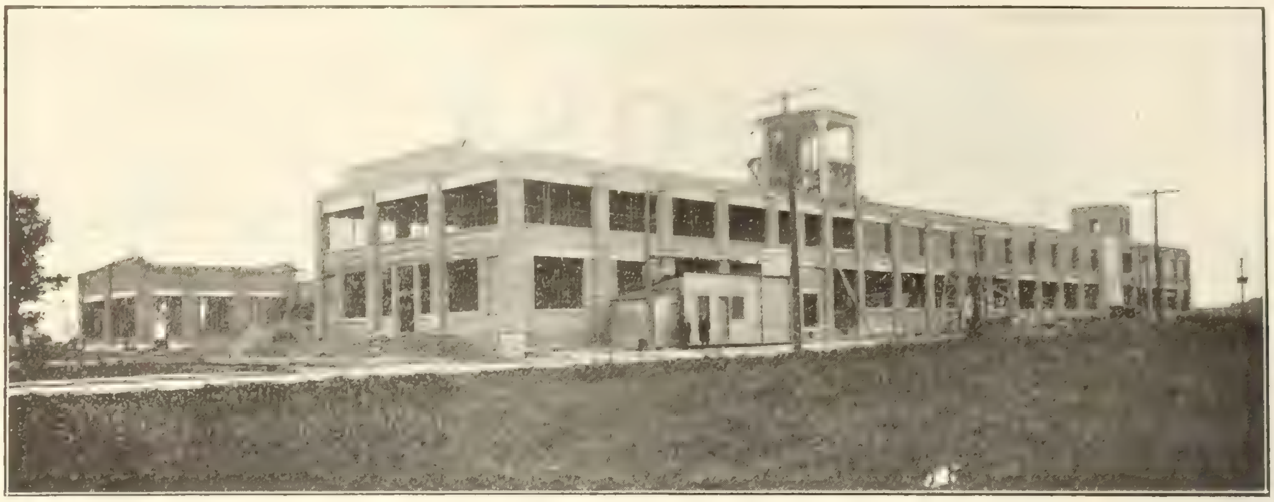

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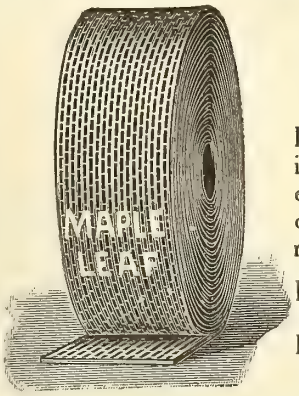

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It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

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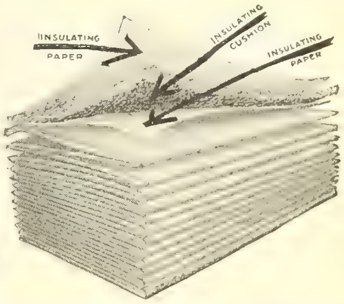

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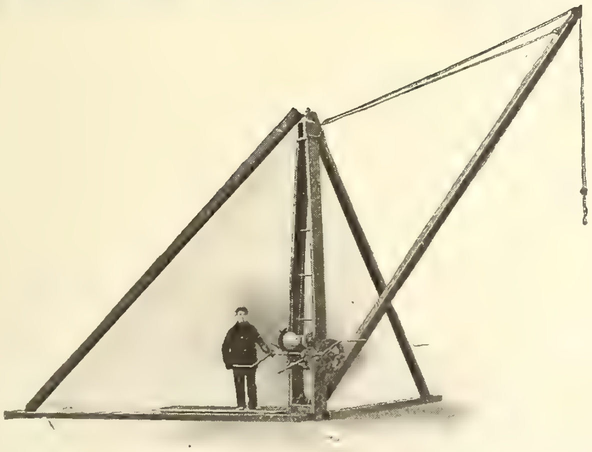
Beath Scotch Derricks

Hand or Power



THE construction of Beath Scotch Derricks embodies several points of merit not found in other makes.

All stress parts are **steel** not cast iron. Bottom Pintle Bearing is of ball and socket type and works in a bath of oil, thus ensuring an easy movement at this joint.

Beath Derricks are provided with self-oiling bearings, ensuring easy operation and reducing wear to a minimum.

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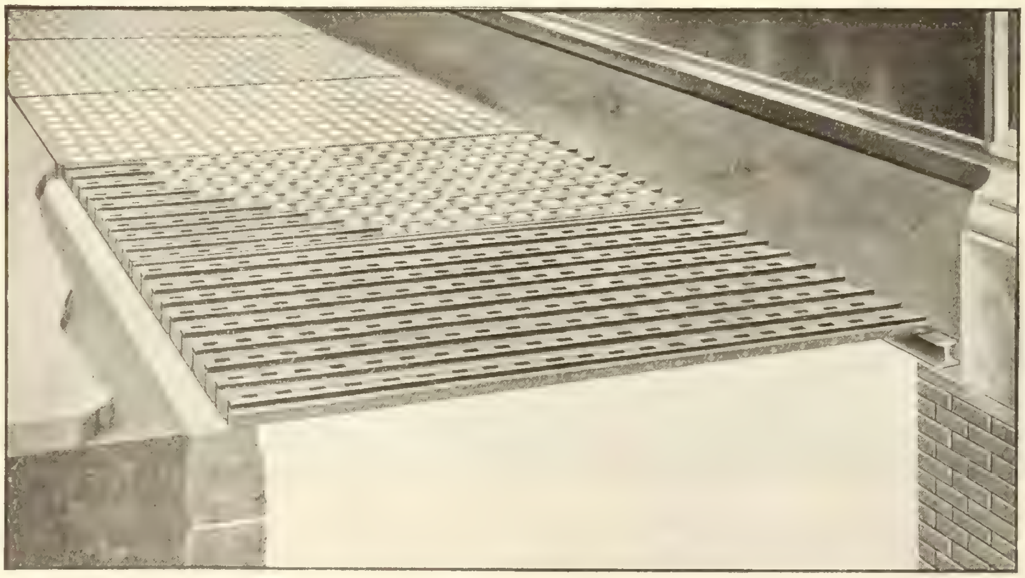

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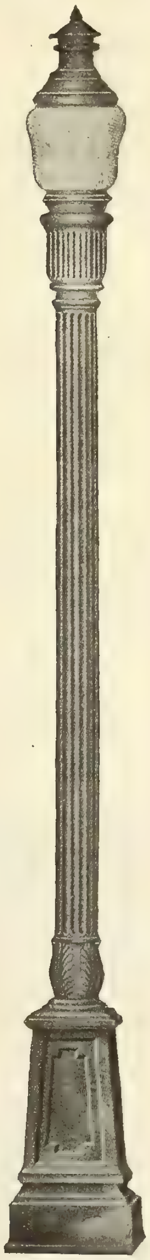

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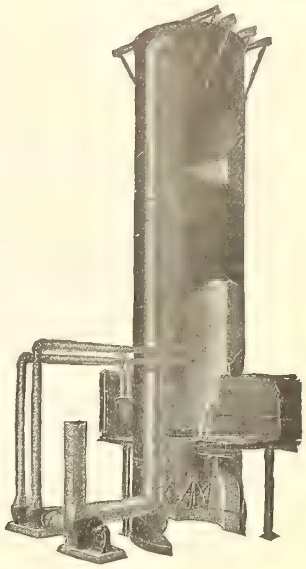

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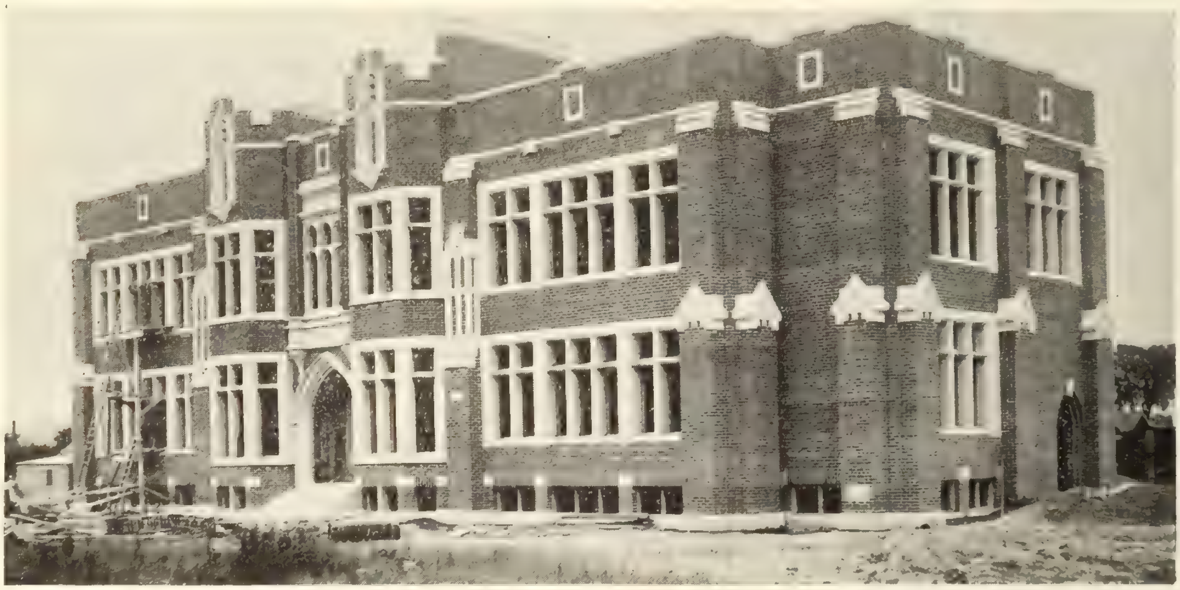

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Vol. 27 **October 1, 1913** **No. 40**

Standardisation of Road Stones and Standard Nomenclature

CONSIDERABLE importance attaches to the "British Standard Specification for Sizes of Broken Stone and Chippings" which has recently been issued by the Engineering Standards Committee. Standardisation is essential to prosperity in every trade, and quarry owners should welcome the possibility of specifications in which the technical provisions will always be practically identical. The vagaries of both engineers and architects have in the past been responsible for endless muddle and delay in the supply of materials, and the sooner the whole field of supplies is placed upon a standardized footing the better will it be for all parties to a contract. The Committee recognized early in their deliberations that in any gauged material there must be certain proportions respectively above and below the nominal size, and that although these should be limited in amount they must yet be sufficient to allow of the quarries complying with the Standard Specification. The Committee have adopted four Standard gauges for broken stone: 3-in., 2½-in., 2-in. and 1-in. The following is the specification for 3-inch stone: "Broken stone specified as 3-inch gauge shall all pass through a 3-inch ring and shall consist of the following percentages by weight:—Not more than 15 per cent. passing through a 2½-inch ring in every direction. Not less than 65 per cent. over 2½ inches, and not exceeding 4 inches, in greatest length by measurement. Not more than 20 per cent. over 4 inches in greatest length by measurement." Proportional allowances are made in the other grades, and it cannot therefore be said that the committee have erred on the side of stringency. As regards chippings the Standard Gauges run in eights of an inch, from 1 in. to ⅛ in., and each gauge is clearly defined. "One inch chippings must all be capable of passing through a square hole of 1 inch side and at least 70 per cent. by weight must be retained by a sieve having square holes of ¾ inch side." A point of no little interest in the Specification is the definition of the terms "gauge" and "size." It is of course quite obvious that "gauge" does not indicate a dimension, but the Committee have wisely retained the use of the term in that sense, owing to the fact that "it is in general use in the quarry industry." "Gauge" then is used to describe the Standard group of sizes into which broken stone is divided, while "size" is used to describe the sub-divisions of the gauge.

In an Appendix to the Report, under the heading "Nomenclature of Road Stones," is given what may be described as an elementary essay in the standardizing of the stones themselves. The details are to be filled in later, so there is no need to go further in the matter at this juncture, but this trial flutter brings to the mind the necessity for a far-enlarged nomenclature, to include not only road stones, but all roads, materials and forms of construction. In the leisurely march of former ages, word-making and phrase-building were among the slowest of processes for the simple reason that there was very little that was new needed description. In these days of swift advancement, the coining of new words and phrases has become an everyday necessity, and unless the utmost care is exercised the confusion which already exists must become worse and worse confounded. This is true of every branch of the sciences and the arts, but a consideration of that obtaining in highway matters will suffice for present purposes. Take the simple matter of applying a coat of tar to a road surface. The process has, a contemporary points out, been variously described as tarring, tar dressing, tar painting, tar spreading, tar spraying, tar treating, tar coating, tar surfacing, tar varnishing, surface tarring, top dressing, flush coating, and superficial tarring. The redundancy of expressions here is absolutely ridiculous, and equally ridiculous are those used in the designation of the various layers of carriageway. Four names would suffice, and some thirty-five have not been found sufficient. To say that these names are coined largely by ignoramuses desirous of impressing their wiser fellows does not clear the air. What is wanted is a committee, a standing committee (an unfortunate expression, by the bye, as it means one that is always sitting) to which new processes and appliances would be referred for naming. The scope of the Engineering Standards Committee is too limited, since any such committee as is suggested would be called upon to prepare nomenclature for the whole of "the sciences and the arts" (taking the expression in its widest sense) and such nomenclature should be adopted by all English-speaking nations. There is no reason why England, Canada and the United States should not converse, at least technically, in one common language. Standardization would follow nomenclature, and both would assist incalculably in the promotion of trade, commercial, professional and scientific intercourse between the various countries. World-wide nomenclature is not yet within the range of practical politics.

At a meeting convened recently in Regina by Mr. R. O. Wynne-Roberts, steps were taken looking to the formation of a Canadian Institution of Municipal Engineers.

Hydro-Electric Power Development Near Calgary, Alta.

Specially contributed by W. W. Hay, B.Sc.

THE Calgary Power Company, Limited, of Montreal, have under construction west of Calgary, at the Kananaskis Falls of the Bow River, a new hydro-electric power plant and they are also installing an additional unit in their plant at the Horseshoe Falls, two miles down the river.

Particular interest is attached to the development at present through the negotiations with the city of Calgary for a power contract. Heretofore the city has been the largest consumer of power from the company and hesitates to enter into further contracts unless the power company will guarantee continuous power the year round. The extreme fluctuations in the flow of the stream preclude the continuous operation of the plant to capacity during periods of low water, forcing the customers to install auxiliary power units in case of failure in delivery of electric power. It is to enable them to guarantee this continuous service that the power company is building the new plant, in spite of conditions which ordinarily would not warrant such a development. It is expected that when the new plant is completed the city of Calgary will enter into a contract for some 5,000 horse-power at $26 per horse-power year, with a reduction of $1 per horse-power year per each additional 1,000 h.p. used, until the price reaches $20 per h.p. year for over 10,000 h.p. per year.

Watershed and Reservoir

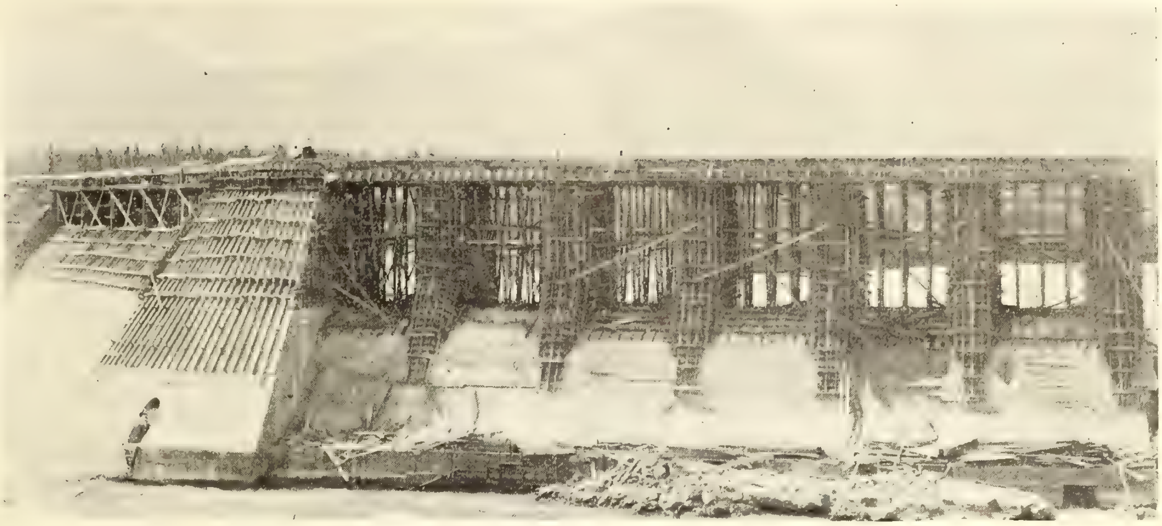
The Bow River has its source at the great divide, in the watershed of the Rocky Mountains, and flows southeast until it reaches the foothills, when it turns to the east as far as Calgary. It then flows south and east to its confluence with the Belly River. Between its source and the plains a number of small streams flow into it from the many mountain valleys that it intersects. Almost immediately after leaving the mountains it is joined from the south by the Kananaskis River, a stream of good size and fairly uniform flow, which has its source in the eastern ranges of the Rockies in muskegs and lakes lying at a considerable elevation. From this point to its junction with the Belly River it furnishes the main run-off channel for the eastern slope of the Canadian Rocky Mountains. At its junction with the Kananaskis River, 53 miles west of Calgary, there is a combined maximum run-off of about 12,000 sec. ft. reached during June, when the snow is melting most rapidly and the spring rains are prevalent. During the winter months, when the run-off from the glaciers and snow-fields is at its lowest, the run-off is as low as 1,000 sec. ft. There are but few available reservoir sites, as the river flows in a very wide, deep valley, and the two sites selected for the power plants with dams are at points where the valley is very narrow, in rock formations. The largest storage reservoir available was the one most easily dammed. Lake Minnewanka, about forty miles west of these developments, has a total length of some twelve miles, with a varying width of less than one mile, and has its only outlet through a very narrow canyon. During the winter of 1912 a dam was built across the Cascade River, at the outlet of Lake Minnewanka, giving a storage of 44,000 acre-feet by raising the level of the lake 12 feet. This is sufficient for a flow at the power stations of 275 sec. ft. during the four most severe months of the winter. The dam lies within the limits of the Banff National Park and in consequence of the agreement with the government, the power company has had to remove all timber and debris from the flooded area and for a distance of ten feet beyond and has left a thimble in the dam whereby the Parks Department may carry out a small development of 800 or 1,000 h.p. for use at Banff and elsewhere. The dam structure is about 70 feet high, constructed between the rock walls of the outlet. It has three stop-log openings 10 feet wide, with deck overhead, and, besides the sluice for the power development, has an unwatering valve 6 ft. in diameter, hand operated. A hand-operated winch running over the dam handles the stop-logs. The dam was designed by the power company and was built in three months, during severe winter weather, by the Foundation Company, Limited, of Montreal.

Addition to Existing Plant

Early during the year 1911, the plant now in operation was completed except for the installation of one 6,000 h.p. unit. The first units installed were one 6,000 h.p. unit, of which the new unit is a duplicate, and two 3,750 h.p. units, with two 150 h.p. exciter units, all of the horizontal type turbine, with direct connected generators. In general, the plant consists of a dam, 400 feet long and 50 feet high, located just above the Horseshoe Falls with the power house just below the falls and about 300 feet distant from the gate house, the water being conveyed to the turbines by rivetted steel penstocks 12 ft. in diameter. At present, power is supplied to a sub-station in the city of Calgary by two 55,000 volt transmission lines, and to a sub-station at Exshaw, for the mill of the Canada Cement Company, Limited, by a 12,000 volt line. The installation of the fourth unit is about completed and consists of one 6,000 h.p. horizontal turbine, manufactured by the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, operating under a 70-foot head at 225 r.p.m., and direct-connected to a 4,000 kv.a. three-phase, 60-cycle, 12,000-volt horizontal shaft a.c. generator supplied by the Canadian General Electric Company, Limited. The new installation necessitated the construction of a new rivetted steel penstock, 12 feet in diameter, controlled by a gate of the "butterfly" type, weighing 25 tons in place. The draft tube was completed in the original construction of the power house. The switching equipment installed in connection with the new unit and its accompanying 3,000 kv.a. three-phase transformer will duplicate that already installed for the control of each of the other units. Provision had been made in the station switchboard design for the control of this generator, as was also the case in regard to exciter capacity and switching equipment.

New Development at Kananaskis Falls

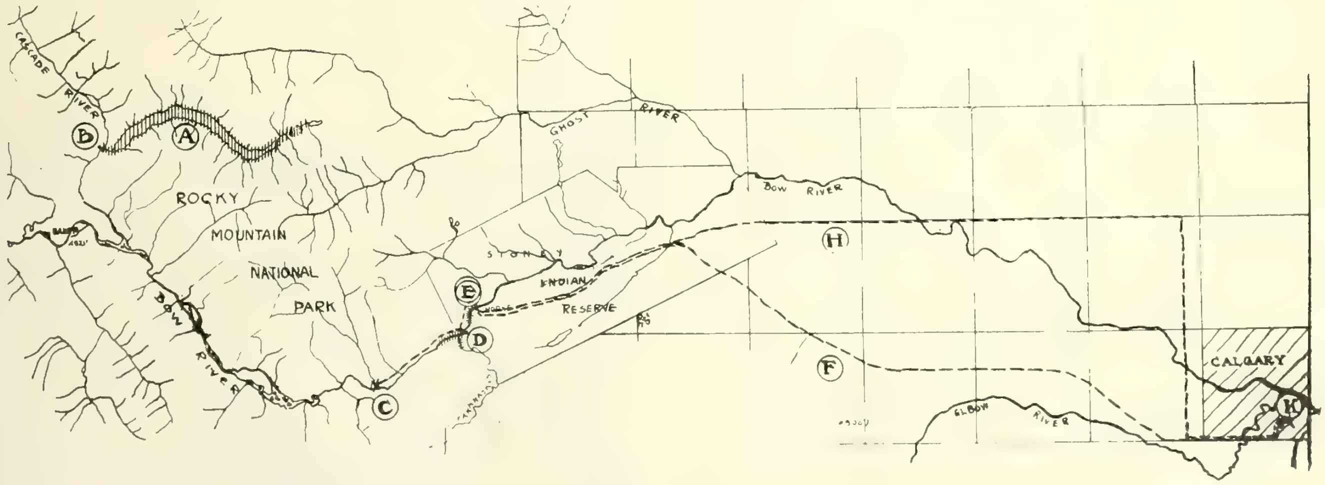
The new power development now in course of construction is about two miles above the operating plant, and well above the backwater from the dam. The gen-



Dam at Kananaskis Falls. Stop-log section under construction.

eral scheme consists of a dam above the falls, a canal flume leading to the headgates, pressure tunnels leading to the scroll chambers of two water wheels, and draft tubes with tail race tunnels to the river below the falls. The dam will have a total length of over 800 feet, including wing walls, is 57 ft. 6 in. high above the lowest foundations, and has 11 stop-log openings 18 ft. wide, main sluiceway with log run, and will raise the water level about 59 feet. The dam will back the water up into the Kananaskis River beyond the Canadian Pacific Railway, necessitating the raising of a two-span bridge a height of four feet, with a corresponding rise in the grade of the railway in either direction. The wing walls are thrown well into the banks at either side, well above the maximum high water mark. There will be a 6 ft. unwatering valve in the dam, besides three tunnels in the overflow section for the observation of seepage. There will be 215 lineal feet of free overflow in the length of the dam, high water level being 20 ft. above the lowest stop-log opening. There will be a deck 20 ft. wide over the sluiceway and stop-log openings, 10 feet wide over the other sections, and upon it will run an electrically operated winch for the handling and placing of the stop-log. The foundation is in general a soft shale, very seamy in spots, and in order to prevent the seepage of water below the dam, the rock is being grouted under pressure so as to fill all seams. Two-inch holes are being drilled about 30 inches apart above and below the dam, Caylx drills being used for drilling, and the holes will be filled with cement grout forced in under pressure. In one instance, during the grouting of one hole in the upstream face, forty bags of cement were required before the flow ceased.

Along the south shore of the river, for a distance of 1,000 feet from the dam, and rising slightly from the height of the top of the dam, there is a ledge of rock similar to that upon which the dam is constructed, and this ledge has been used as a natural dam for the canal flume, which has its head at the south end of the dam and in the east bank of the Kananaskis River. The rock in general is a soft, seamy shale alternating with occasional thin beds of sandstone, the whole formation belonging to the Jurassic Period. The first 200 feet of the canal will run through a deposit of gravel overlying the rock, and the rest of the section must be cut through the solid rock. The canal will be over 700 feet long, with a trapezoidal section, in gravel, 80



Map showing watershed, location of power stations and market.

feet wide at the top, [illegible]0 feet wide at the bottom, having a normal operating depth of 1[illegible] feet. Through rock the canal section will be rectangular in general 50 feet wide and 15 feet deep. The section in gravel will be lined with concrete, the remaining length being unlined to the headgates. The rock left in place at the head of the canal forms a natural dam to the water and the water will pass through the headgates into pressure tunnels leading to the scroll chambers. These tunnels, together with the power works and tailrace, are cut through solid rock, and, with the canal section through rock, involve the removal of some 45,000 cubic yards of rock excavation. Gratings will be placed in front of the headgates, and in front of the gratings will be stop-log gates to allow for repairs to the main gates. The headgates will be steel rivetted Tainter gates, operated by electric winches placed in the gate-house above. Four concrete lined pressure tubes lead from the gates and develop into scroll chambers formed in concrete in which are set the two turbines. Two 5,800 h.p., vertical, single runner, mixed flow hydraulic turbines set in the scroll chambers will be direct connected by 15 in. steel shafts to 4,250 kv.a. three-phase, 60-cycle, 12,000 volt, vertical, alternating current generators. The centers of the water wheels will be 55 feet below normal water level, operating under a 68 ft. head at 164 r.p.m. In addition there will be an exciter unit of 150 h.p. with separate penstock and draft tube. Turbines and generators are being supplied by the Canadian Allis-Chalmers, Limited. The floor of the power house will be 25 feet above the center of the turbines; the power house will be 40 ft. wide by 90 ft. long, and 37 ft. high, of brick and steel construction, with steel roof trusses, and will house a 50-ton travelling crane for use in handling the machinery. From the turbines the water will flow through concrete lined draft tubes to the tail-race. The draft tubes are 9 ft. in diameter at the wheel, and develop from the circular section to a rectangular section, 14 ft. by 16 ft., at the entrance to the tail-race tunnels. Normal tail water will be 15 feet below the center of the turbines. There will be two tail-race tunnels, 186 ft. long, 14 ft. wide, and 18 ft. high with semi-circular tops, lined with concrete. At the end of the tunnels in the river are stop-log piers for checking the entrance of the tail water into the tunnels in case of extreme high water.

Dam at Kananaskis Falls—Log-run and spillway section.

Electrical Equipment and Transmission Lines

The present transmission system consists of two 55,000 volt lines, 50 miles in length, each of No. 0000 stranded aluminum cable carried on substantial wooden poles with cross-arm construction, serving the sub-station in the city of Calgary, and two 12,000 volt lines, 25 miles in length, of the same construction, serving the station at Exshaw, where transformers and synchronous apparatus are installed to obtain power at an operating voltage with good power factor. Under ordinary circumstances, the two 12,000 volt lines serving Exshaw will be carried by the new plant, and provision has been made in the switching equipment to enable this load to be transferred to the 12,000 volt busses at the present plant. In addition, outgoing feeders will be installed for the purpose of connecting the 12,000 volt busses of the two stations, enabling the new plant to feed the 55,000 volt lines to Calgary through the step-up transformers at the present plant. The switchboard gallery is 19 feet wide, running the full length of 90 feet along the east side of the power house, and contains the station service, exciter, and remote control boards. Generator circuits and outgoing feeders are operated by remote control, electrically operated, circuit breakers installed in the high tension chamber. Owing to the necessity of handling two 12,000 volt incoming lines from the new plant, in addition to the Calgary and Exshaw out-going lines, the installation of three 12,000 volt busses and two 55,000 volt busses was provided for in the original layout of the present plant. Interconnection of the low tension busses provides for the operation of the outgoing lines from a combination of any of the four units in the present plant as well as from either or both of the two units in the plant now under construction, an arrangement of maximum flexibility. In order to handle the increased load on the high tension line, it is intended to erect two additional 55,000 volt transmission lines serving the Calgary Sub-station. The survey for the first of thees lines has been about completed, and the other will be surveyed at once. The route of these two lines will follow closely that of the most northern of the existing high tension lines. All switchboard and transformer equipment in the operating plant, as will be the switching apparatus for the new plant, was supplied and installed by the Canadian Westinghouse Company, Limited.

Construction Methods

The isolated location of the power development has necessitated the building of nearly two miles of sidings, including a timber trestle over the Kananaskis River, a camp for the feeding and shelter of over 500 men, together with power plant and pumping stations, with other necessary adjuncts for the conduct of so large a job of construction. There are at present over 450 laborers and mechanics employed con-

Power house at Horseshoe Falls, showing new penstock.

tinuously, about 100 of these being on night shift to carry on blasting and excavation. Work on the dam was commenced during the month of February, 1913, and has been prosecuted with vigor so that it is expected to have the entire plant completed and in operation by the first of November. In the beginning a steam power plant was installed, using two 100 h.p. Leonard boilers, and supplying steam for the Sullivan air compressor and pumps, besides an engine used for the driving of machine and wood-working tools, and a 35 h.p. dynamo for electric lights. As the work progressed the dynamo was overloaded, without the possibility of adding to the load on the boiler, so that transformers were installed that would later be required in the equipment of the power plant, and all the electric energy required was "stepped down" from the 12,000 volt line running past the site to Exshaw. After the construction was well under way, a bed of excellent gravel was uncovered within 2,000 feet of the dam and close to the power works, and a Model 20, Marion steam shovel, with one cubic yard dipper, was installed to move it. The gravel proved to be entirely suitable for the work in hand, being well graded in the bank, and containing but 6 per cent. of clay loam. Weekly tests have been made as the work progressed, and have enabled the engineers to satisfy themselves as to its suitability. It is estimated that the proximity of this gravel to the work will result in a saving of about $4 per cubic yard of concrete, or some $100,000 in the original estimates. The gravel is hauled to the concrete plant in 6 cu. yd. side dump cars moved by a Vulcan steam contractors engine. The concreting plant is situated at the end of the main dam, about 1,000 feet from the power works proper, and consists of two 1 cu. yd. Milwaukee mixers, with hoisting towers and distributing system. The mixers are placed 30 feet below the track level, gravel being dumped from the cars into wooden hoppers having a capacity of 120 cubic yards of material, and dropping through four sheet-metal tubes with arc gates, directly into the charging hoppers of the mixers.

The cement shed is close to the mixers, at the track level, and the cement in sacks slides down an incline to the platforms in the rear of the mixers. There are two hoisting and distributing towers, one 40 feet high serving the main dam, the other 60 feet high for other concreting. Insley hoisting buckets and hoppers are used in both towers. Concrete for the dam was placed from a track running along the deck upon which were run one cu. yd. side-dump industrial cars charged from the hoppers in the towers. That portion of the concrete nearest the high tower was placed by spouting through an 8-in. open trough direct to the final point. This plant has already been used for placing over 15,000 cubic yards of concrete, and has attained a maximum of 350 cu. yds. of concrete in one 10-hour shift.

Concrete for the canal and other works is being placed from the same plant, conveyed from the mixers in side dump cars lined with cement sacks to keep tight. A gate arrangement at the hopper of the tall tower enables an operator to turn concrete from the chute into the cars standing on the tracks. The cars are then hauled to the dumping spot by the "dinkey" engine, and the concrete dumped into hoppers, whence it is conveyed by closed chutes to its final position. These chutes are practically vertical, being as long as 90 feet, and are 10 inches in diameter, fabricated from sheet metal.

In the construction of the dam, a cofferdam of 2 in. by 10 in. planks was first built, leaving a temporary sluiceway 104 feet long at the north shore of the river, and another 18 feet wide in one of the stop-log openings next the south end of the dam. All concrete is being deposited in wooden forms built of heavy timbers and amply braced, with planed surfaces where ever in contact with the concrete. Concrete has been deposited in sections the width of the stop-log openings. There will be about 20,000 cubic yards of mass concrete deposited before the completion of the dam.

Excavation of the canal section in gravel is being carried out by means of a Model 30 Marion steam shovel with a one-third cu. yd. dipper, loading into dump cars on the track between dam and power works. Two 12-yd. and eight 6-yd. Peleter side dump, wooden cars have been kept in constant use handling excavation and concrete. Rock is excavated by blasting and manual labor, eight Holman compressed air drills being in constant operation in the canal section through rock and in the wheel pit and tail-race tunnels. Excavation from the pit and tunnels has been removed in steel stone-boat hoisted by two 5-ton stiffleg derricks operated by Marsh-Henthorn steam hoisting engines. One of these derricks operates a one cubic yard Hayward clamshell bucket for excavating portions of the canal prism next the headgates. For the construction of the two tail-race tunnels, a heavy timber cofferdam was constructed at the foot of the ledge of rock in the river, and the tunnels were driven from the river face while excavation was in progress for the pressure tunnels and wheel pits. The second bench was then driven from both ends to completion. Concrete for lining the scroll chambers, draft tubes and tunnels is being placed from the track above, the forms being built on the ground above and lowered to place by the derricks used for excavation.

Storage dam at Lake Minnewanka.

To date the concrete has been placed for all the dam sections except the temporary sluiceways, and the concreting of the scroll chambers and draft tubes is well under way. So far there have been no fatal accidents, though construction has been in full swing for over five months.

The estimated cost of the construction is $750,000. The plant has been designed and the entire construction is being carried out by the Power Company, for whom Mr. H. A. Moore, is the general manager and chief engineer. All detailed plans have been made at the site under the immediate direction of Mr. Harold A. Johnston, resident engineer. There are nine engineers and draftsmen employed for field and office work at the site. Mr. A. W. Allen is the superintendent of construction. The electrical equipment installation is under the direction of Mr. A. Barnes, operating superintendent for the company's plants. The author is endebted to the company's officers for their courtesy in enabling him to gather the details set forth above, and to Mr. Wm. Smith, of the Canadian Westinghouse Company, Limited, for the brief particulars of the electrical switching installations.

Purchasing through the Consulting Engineer

IN the present state of engineering development a good many people appear to be somewhat at sea regarding the wisdom of employing an expert adviser in connection with the purchase of machinery and supplies. This ought to be a pretty late day to set up an argument as to the benefits of a consulting engineer's services. The increasing complexity of modern industry, the interconnection of technical specialties, and the multiplying resources of the manufacturers leave no room for discussion as to the real economy of outside advice of the right kind, by the bonafide expert, rendered to the plant owner who is by force of circumstances unable to maintain a specialized knowledge of many auxiliary matters bearing upon his business. It is a difficult enough job to keep up to the times in any branch of applied science, manufacturing or business, to-day without attempting to be one's own guide, philosopher and friend in solving stiff problems outside one's normal line of work.

On some kinds of work the routine services of a purchasing bureau are no doubt sufficient for all practical requirements, provided those are supplemented by the scrutiny of the owner's technical staff. Successful experience with given makes of apparatus not involving large individual investments per unit naturally leads to "repeat orders" on which the expenditure of any considerable sums for outside advice is often needless. It requires good judgment to know when the duplication of supplies and machinery should be called into question and expert advice sought on later products. Where the investment is large the purchaser will do well, before placing a repeat order, to ascertain whether the last type of apparatus installed represents the latest and most economical machinery available for the desired service, making a special point of determining whether the service itself may not have changed sufficiently to warrant fresh engineering consideration of the best methods of meeting the demands. This may at times be done within one's own organization with entire success, while in other cases it must be done by the aid of outsiders. In a nutshell, the retention of a consulting engineer in every case should depend upon the magnitude of the problem at issue, the uncertainty of the solution, the amount of money involved, the possibility of difficulties in the execution of the project, and, perhaps above all, upon the knowledge of the purchaser or his engineering staff of the class of work contemplated. Self-sufficiency is a dangerous trait in handling new engineering problems; if there exists any doubt as to the proper machinery or supplies for an important piece of work the safest course is to put the problem in the hands of a consulting engineer of acknowledged standing.

The troubles which follow undue reliance upon purely "home talent" or upon salesmen in the purchase of engineering equipment are well set forth in a contribution to the Engineering Supplement of the London "Times" of August 20. The writer deprecates falling back upon the advisory service of sales engineers, discusses the preparation of specifications by amateurs, and, after exposing the pitfalls of guarantees inadequately demanded by novices or unsuspiciously swallowed whole by non-technical apparatus buyers, outlines the duties of a consulting engineer in the selection of power-plant equipment. He shows that the sales engineer, no matter how honest, cannot but be biased in favor of his concern's products. Such a man may well be called into conference in the purchase of equipment and his recommendations given due weight; but it pays to go slowly in accepting anything extensive in the way of designing from such sources.

The subject of specifications affords material for a treatise. Here the independent purchaser often fails utterly, either by loose expressions which easily can be evaded or by excessively strict requirements at unimportant points, which increase the cost of his apparatus far beyond what it would have been had a consulting engineer been employed. The man who buys machinery without adequate knowledge as a guide runs grave risk of getting little for his money. Attempts to cover one's own ignorance by ready-made specifications based largely on the generalities of manufacturers' tenders are pretty certain to result disastrously. Makers' specifications seldom include everything necessary for complete plants, the consequence being that the unsuspecting purchaser is finally overburdened with the cost of extras which he did not anticipate when he placed his order.

Without the consulting engineer, or, in his absence, the properly qualified technical adviser or group of experts on the staff of the purchasing organization the buyer is liable to be exposed to the evils of "leaky" guarantees, unskilled analyses of bids, scattered responsibility for the operating results of diverse apparatus assembled under a single roof, insufficient inspection of work in progress in the manufacturer's shops, delays in placing orders and in stimulating shop production, drawings lacking necessary details for the most rapid filling of orders, unreasonable or inadequate specifications, and ignorance as to the apparatus which in the long run will prove the best, all factors considered, and consequently the least costly for the required service. The cost of expert advice, in cases where the resources of one's own staff are insufficient—as they often must be on account of rapid progress in every branch of engineering—is too small a proportion of the total expense of a well-conducted undertaking to justify the slightest hesitation on the part of a wise purchaser to avail himself of this aid toward economy.

The Philippine government has recently announced the plan for a comprehensive system of loans from public funds for public improvements. In all, about $15,000,000 in gold is involved, which will be spent mostly for various municipal improvements. The present schedule calls for 66 reinforced concrete market places. Plans and specifications for these have been prepared and construction will proceed at once.

Plain Concrete Paving

What has been learned from Mason City work

By F. P. Wilson, City Engineer

I HAVE tried here to set down, from my experiences and several years of investigation, what I deem necessary to obtain satisfactory results in the construction of cement concrete pavements. The important essentials which should enter into the construction of concrete paving are:

1—To have the sub-grade thoroughly drained where it is necessary, by using farm drain tile not less than 4 in. in diameter, after which the sub-grade should be rolled and compacted with a heavy steam roller until it is perfectly solid over its entire surface.

2—After the sub-grade has been prepared, great care should be taken to keep it wet, before placing the concrete, as a dry sub-grade draws the moisture from the concrete mixture and is thus harmful.

3—Have a first-class Portland cement that will stand the tests required by the American Society of Civil Engineers.

4—Have a sharp, clean sand, which does not contain more than 2 per cent. of loam.

5—Have a good hard limestone or other stone equally as good, free from dust, loam or clay, and crushed so that it runs from ¼ in. to 1¼ in. in size, 66 per cent. of the stone to be the coarser and 34 per cent. the finer of the stone aggregates.

6—For the base concrete, use the proportions as follows:

1 part Portland cement by measure.
2 parts sand by measure.
5 parts stone by measure.

7—The fine aggregates and coarse aggregates should be thoroughly mixed with a good batch mixer, until all stone is coated and is of such consistency that all it requires, is to level off the mass so that the concrete runs into place, no tamping being required and a dense, compact volume is obtained.

8—For the wearing surface use the proportions as follows:

1 part Portland cement by measure.
1 part screened sand by measure.
1 part screened, ¼ in. crushed granite.

The proportions to be thoroughly mixed to a proper consistency with a good batch mixer.

9—After the concrete or base has been placed, put, on immediately the top or wearing surface so that there is a complete bond between top and base.

10—Have an expansion joint 1 in. in width left next to the curb on each side of the street, this space to be filled with an asphalt filler. Have transverse expansion joints ½ in. in width left every 37 ft. 6 in. at right angles with the curbs, these expansion joints to be protected on either side with steel plates 2½ in. in depth, ¼ in. in thickness, with a shear member 6 in. in length cut out of the sides of the plates at equal distances and bent at right angles and extending into the concrete, these steel plates to be not less than 10 ft. in length. Between these plates place a 3-ply tar felt paper especially prepared for the expansion joint.

11—A contraction or blind joint should be left every 12 ft. 6 in. at right angles with the curbs, these joints to be clear through pavement from top to bottom, on the top or surface of pavement the joints floated over and not lined or corrugated.

12—For the crown of concrete streets use the same crown that is used on the other kinds of pavements for different width of roadways.

13—The wearing surface should be finished off with a wood float made of a coarse grained soft wood, so as to give a uniform rough surface which will give a good foothold.

14—The curing of concrete pavement is one of the most important features and on it depends the durability and strength. A concrete pavement immediately after it is laid, should be covered and protected from the sun, and as soon as it is hard enough, should be sprinkled frequently and kept wet not less than 8 days.

15—Concrete paving, where the width of roadway is more than 20 ft. between curbs, should be reinforced with No. 7 American wire to eliminate cracks or cracking.

16—A concrete pavement, after it is laid, should be protected and the traffic kept off for at least 3 weeks so as to give it a chance thoroughly to harden.

17—To obtain first-class results in the construction of concrete streets every detail as heretofore described must be followed.

The methods described, I have followed in the construction of 200,000 sq. yds. of concrete paving and the results speak for themselves.—**Concrete Cement Age.**

The Use of Cinder Concrete

WITH every succeeding year the utilization of reinforced concrete for building purposes of every sort is becoming more and more general. Both from experience with actual constructions and through the use of tests, engineers are able to foretell how the various forms of the material will act under different conditions. Moreover, in the field of fireproof construction of buildings, concrete stands pre-eminent, with regard to durability, economy, and fire-resisting qualities. Many interesting facts have been brought to light with regard to the manner in which concrete withstands fire, and the investigations along these lines have been thorough and far-reaching.

The use of cinder-concrete in fire-proof floor construction has been growing in popularity from day to day. Objections to the use of this material have been advanced, in view of the fact that in some cases where it has been used, piping for the sprinkler systems or for other purposes has been corroded to such an extent as to be rendered useless. For this corrosion the cinder-concrete has been blamed. However, it has been demonstrated that, if the cinders are not new, are free from sulphides, and that if the mixture consists of one part of cement to ten parts of cinders, with enough sand to make a dense mixture, there is little or no danger of the corrosion of water piping.

A recent fire, water and load test, carried on upon cinder, terra-cotta and gypsum floor arches, showed that the first-mentioned material was the best of the three. A fire was kept burning continuously below the floor for a period of four hours, and during that time the floor was subjected to an average temperature of 1,700 deg. F. At the end of the four hours a fire stream was turned on the roof while it was still red hot. The floor load during the test was 150 pounds per sq. ft.

The cinder-concrete suffered very little damage, and the test served to furnish an additional proof that this material is an excellent fire-resisting medium.

Results of Mechanical Gravity Filtration at Saskatoon, Sask.

By George T. Clark, City Engineer

THE city of Saskatoon obtains its water supply from the south branch of the Saskatchewan River. This river and its tributaries are being polluted by the sewage from a number of towns and cities, including Calgary, McLeod, Lethbridge and Medicine Hat. In addition to being contaminated, the water of this river is very turbid at certain seasons of the year, and it is generally believed that a turbidity in the water such as is presented in this case, consisting to a large extent of fine quartz particles, predisposes to enteric conditions. For these two reasons, therefore, namely periods of excessive turbidity and danger of contamination, the civic authorities decided that it was advisable to take the necessary steps to purify the water, and the writer was requested by the city to report on the subject of filtration. Before doing so, some filtration plants of different types were visited, including those at Albany, N.Y.; Hackensack, N.Y.; Harrisburg, Pa.; Philadelphia, Pa., and Columbus, Ohio. The outstanding features of each were noted.

Requirements of Water for Domestic Purposes

Water which is required for domestic purposes, should possess the following qualities:—(1) It should be free from disease-producing germs; (2) it should be free from those allied organic forms, which are not conducive to health, although they may not as yet be recognized as accompanying disease; (3) it must be uniformly clear and free from turbidity, whether it be produced by mineral or organic matter; (4) it must be free from color, odor and taste.

The methods adopted by the city of Saskatoon to accomplish these results may be divided into three steps, viz:—sedimentation, filtration and sterilization.

Sedimentation

The sedimentation basin has a capacity sufficient to give the water eight hours' subsidence when the filter is working at full capacity, and is divided into two parts by a weir wall across the centre. In the north half of the basin, plain sedimentation takes place, and in the south half, sedimentation and coagulation. The coagulant used is sulphate of alumina, because the water has a sufficient alkalinity content, so that sulphate of alumina present the necessary reaction to form an alumina hydrate, which, in precipitating, coagulates much of the organic matter, and drags down the finer suspended matter.

Provision has been made for applying the coagulant at three points: (1), when the water enters the basin; (2), when it passes over the weir; (3), just before it enters the filters.

The solution of sulphate of alumina used is 350 lbs. to 1980 I.G. of water or 1.8 per cent. solution.

Filtration

The three best known types of filters were duly considered before a decision was reached as to which one was best suited to our purpose. A strong point in favor of the pressure filter was that with this type of installation one system of pumps would have been all that was necessary to deliver the water from the river direct to the distributing system, whereas with either of the other systems a double pumping system is necessary. The excessive turbidity of the water, however, made preliminary sedimentation absolutely necessary, and the idea of installing pressure filters, therefore, had to be abandoned. The gravity mechanical filter was chosen in preference to the slow sand type for the following reasons: (1), the mechanical filter will handle fifty times more water per unit of area per day than the slow sand filter; (2), the mechanical filter, on account of its being much smaller in area, is much more easily protected from excessive cold; (3), the initial cost of construction is about one half; (4), the cost of operating slow sand filters in the case of highly turbid waters is much in excess of mechanical filters; (5), cleaning the surface of slow sand filters requires the dangerous personal contact of workmen.

Description of Plant

The mechanical plant installed consists of the following:

(1) One filtered water basin, capacity 125,000 Imperial gallons.

(2) Six concrete filter units, each with an effective filtering area of 290 sq. ft. The filtering material consists of an 8-in. layer of gravel, graded in sizes from .2 to .5 of one inch, the larger pebbles being placed on the bottom and a 36-in. layer of sand graded from .36 of a millimeter to .55 of a millimeter, and consisting of hard silicious material free from vegetable matter or other foreign substance.

(3) A wash water pump and motor.

(4) An air compressor.

(5) A complete apparatus for preparing and feeding sulphate of alumina, and hypochlorite of lime.

(6) Hydraulically-operated valves for controlling the operations of the filter units.

Sterilization

This is the third operation which is sometimes required to be performed in cases where harmful bacteria are still present in the filtered water. It consists in our case of the addition of hypochlorite of

TABLE I.

Monthly expense report for the month of August, 1913.

Filtration Plant

Salaries of Operators and Superintendent	$315.00
Bacteriologist	59.33
Additional labor, none.	
Alum, 4,550 lbs. at $2.25 per cwt.	102.37
Hypochlorite, 240 lbs. at $2.74 per cwt.	6.58
Wash water, 1,922,000 gallons at 6c per 1,000 gals.	115.32
Stores, none	
Power, 1,077 kw.h. at 6c per kw.h.	64.62
Light, 235 kw.h. at 6c per kw.h.	14.10
Heat, none.	
Repairs, none.	
Laboratory, fixed charge of	25.00
Interest and sinking fund	400.00
Total cost for month	$1,101.32
Water filtered for month, 57,283,000 gallons.	
Cost of filtering per 100,000 gallons	1.93

lime in the form of a .5 per cent. solution and is applied to the water at the point where it enters the filter beds. The total amount of hypochlorite used by us since the plant was first put in operation in June, 1912, was only 900 lbs.

Results

Table I.—Appended hereto is a typical monthly operating cost sheet. It will be noted that the chief items of expense are salaries of Superintendent and operators, and the charge for interest and sinking fund. The cost for filtration for the month of August, 1913, per 1,000 imperial gallons was 1.93 cents.

Table II.—Shows in detail the operation of the plant during the month of August. The quantity of water pumped and filtered, the chemicals used, and the turbidity of the water is given for each day. Sixty per cent. reduction of turbidity is accomplished by sedimentation.

Table II.—Illustrates clearly how the amount of coagulant required and the amount of wash water used vary directly as the turbidity. The amount of coagulant required varies from about one-quarter to one and one-half grains per gallon with an average for eight months of three-quarters of a grain, while the amount of wash water required varies from two and one-half to five per cent., with an average for eight months of 3½ per cent.

Table IV.—Shows that although the superintendence, interest and sinking fund remain constant, the turbidity is of sufficient range to vary the cost of filtering from a minimum of 1.4 cents per 1,000 I.G. to a maximum of 2.16 cents per 1,000 I.G., or an average for the eight months of 1.77 cents per 1,000 I.G. It is of interest here to note that the turbidity of the South Saskatchewan River water varies from 30 parts per million to 3,750 p.p.m.

Table V.—Shows the bacterial removal efficiency for eight months. For six months the removal has been over 97 percent. For the month of February the removal was only 80 per cent., but the bacterial count in the raw water was very small. The high count in the raw water in March is accounted for by the melting of the snow during that month and the consequent depositing in the river of the filth collected in the snow during the winter months, and also by the increased volume of water underneath the ice scouring the river bottom.

A study of these records shows that the plant, in respect to wash water required and bacterial removal,

TABLE II.

Summary of Water Filtered, and Chemical Distribution for Month, August.

August	Venturi Gallons per day	Wash-water Gallons per day	Alum used Grains per day	Alum used Grains per gal.	Chloride Grains per day	Chloride Grains per gal.	Turbidity raw	Turbidity treated
1st	2,043,000	72,000	1,208,644	0.57	123,600	0.058	130 ppm.	100 ppm.
2nd	2,027,000	72,000	938,304	0.45	185,380	0.089	130 “	100 “
3rd	1,468,000	72,000	982,584	0.64	77,250	0.05	130 “	100 “
4th	2,082,000	72,000	1,009,152	0.45	47,628	0.06	110 “	65 “
5th	2,081,000	72,000	1,009,152	0.45	126,908	0.059	120 “	65 “
6th	1,856,000	72,000	912,744	0.47	63,504	0.060	120 “	100 “
7th	1,827,000	72,000	623,520	0.33	0	0	100 “	90 “
8th	1,772,000	72,000	752,084	0.41	0	0	100 “	90 “
9th	1,643,000	72,000	623,520	0.36	0	0	100 “	85 “
10th	1,464,000	......	623,520	0.43	0	0	75 “	55 “
11th	1,706,000	72,000	703,860	0.4	0	0	75 “	55 “
12th	1,737,000	60,000	623,520	0.35	0	0	75 “	55 “
13th	1,817,000	60,000	691,584	0.35	0	0	95 “	75 “
14th	1,688,000	60,000	665,860	0.38	0	0	75 “	55 “
15th	1,748,000	60,000	666,060	0.36	0	0	65 “	50 “
16th	1,793,000	60,000	666,060	0.36	0	0	65 “	45 “
17th	1,487,000	......	623,520	0.40	0	0	65 “	45 “
18th	1,750,000	60,000	623,520	0.34	0	0	80 “	55 “
19th	1,660,000	60,000	768,132	0.45	0	0	130 “	80 “
20th	1,842,000	60,000	1,328,863	0.7	0	0	180 “	70 “
21st	1,701,000	60,000	1,238,823	0.7	74,088	0.07	150 “	45 “
22nd	1,869,000	60,000	1,210,008	0.63	127,008	0.066	180 “	45 “
23rd	1,893,000	50,000	1,210,008	0.62	127,008	0.065	250 “	65 “
24th	1,559,000	60,000	1,067,728	0.66	127,008	0.078	200 “	70 “
25th	1,937,000	60,000	1,158,203	0.58	68,790	0.06	180 “	70 “
26th	1,917,000	72,000	1,702,913	0.8	108,528	0.09	250 “	70 “
27th	1,920,000	72,000	1,953,542	0.98	186,048	0.093	350 “	65 “
28th	1,856,000	72,000	1,869,999	0.96	186,048	0.096	400 “	45 “
29th	1,910,000	72,000	1,524,839	0.76	54,264	0.094	300 “	30 “
30th	2,061,000	72,000	1,438,727	0.69	0	0	300 “	35 “
31st	1,347,000	72,000	1,451,200	1.plus	0	0	500 “	100 “
	55,361,000	1,922,000	31,870,204	0.556	1,683,060	0.063		

Water pumped to city mains, 55,361,000 gallons.
Wash-water used, 1,922,000 gallons.
Total water filtered, 57,283,000 gallons.
Pounds of sulphate of alumina, 4,552.8.

Pounds of hypochlorite of lime use, 240.
Average turbidity of raw water, 167 ppm.
Average turbidity of treated water, 67 ppm.
Percentage reduction turbidity by sedimentation, 60 ppm.

has fulfilled the guarantee given by the Roberts Filter Manufacturing Company, who installed it.

TABLE III.

Summary showing average for eight months' operation

	Alum.	Wash water	Filtered water	Cost per 1000 galls.
January	None	1,300,000	78,095,704	1.23 cents
February	None	1,213,968	75,631,738	1.19 "
March..	1,900	2,323,000	82,321,140	1.27 "
April	19,380	4,388,880	79,591,588	2.04 "
May.	11,580	2,800,000	61,919,060	2.13 "
June	12,675	2,842,800	59,416,800	2.30 "
July	7,475	2,316,000	58,541,000	2.04 "
August.	4,550	1,922,000	57,083,000	1.93 "
Total	57,560	19,106,640	552,600,030	

Average grs. of alum per gal. for period of excessive turbidity	1.52
Average grs. of alum per gal. for period of normal turbidity	0.28
Average grs. of alum per gal. for period of eight months	0.73
Average amount of wash-water for period of excessive turbidity	4.9 %
Average amount of wash-water for period of normal turbidity	2.58%
Average amount of wash-water for period of eight months	3.45%

TABLE IV.

Average cost of operation

Average cost of filtering 1,000 Imp. gals. during period of excessive turbidity	2.16 cents.
Average cost of filtering 1,000 Imp. gals. during period of normal turbidity	1.4 "
Average cost of filtering 1,000 Imp. gals. during period of eight months	1.77 "

TABLE V.

Bacterial Removal

Month	Bacteria		Efficiency
	Raw Water	Filtered Water	Per cent. Removal
January, '13	27.0	1.4	98.5
February	2.5	0.5	80.0
March	11,144.0	16.0	99.8
April	4,644.0	20.0	99.6
May	4,172.0	37.0	96.7
June	2,553.0	28.0	99.0
July	7,358.0	21.0	99.7
August	2,199.0	42.0	98.1

Opportunities in Engineering

IN a recent editorial the New York "Times" commented as follows on engineering work: "There is a dearth of engineers and there is a mighty good livelihood awaiting those who enter this profession. Other professions are overcrowded. We should think that young men about to enter college would consider seriously the opportunities of engineering." As was to be expected, these views were promptly characterized as erroneous by readers of the paper. Unfortunately there is much misconception as to the opportunities in engineering work, and especially as to the monetary returns, though it is less pronounced than it was ten years ago, says the Engineering Record. Then the air was full of tales of the remarkable future in engineering and technical schools were swamped with young men who had picked an engineering career not because they had an aptitude for the work but because in very many cases they had no special tastes for any line and chose the one apparently offering the most alluring financial inducements. They were caught by the lure of gold and became square pegs in round holes. The situation is changing, not only because the truth as to engineering prospects is better known but because the "business" courses have come into prominence and are believed to be a more direct route to captaincies in industry and commerce. The truth is that an engineering career must be selected as one would choose law, or medicine, or the ministry, or teaching—not for financial reasons but because of aptitude and liking for the work. To those who select it for these reasons there are good opportunities—but the boy whose eye is covered by the dollar and who has no sincere interest in things mechanical will be sure to fall into the ranks of the discontented if a kind Providence does not guide him into some non-technical allied line. If his chief aim in life is a monetary reward he must select some other profession than engineering. Yet, in one respect, the "Times" editorial was correct, for even the misfit can, and generally does, earn a "mighty good livelihood." That will be disputed, of course to the extent that there is difference of opinion as to what constitutes a "mighty good livelihood." If the returns of men in financial life are taken as the standard, the statement is wrong; but for men of sobriety, reliability and application, with a taste for engineering work, the financial returns and the opportunity to branch out in the often more renumerative fields of contracting, manufacturing and business fully justify the statement made in the "Times."

A 20-in. Dow centrifugal pump belted to a 100 h.p. Westinghouse induction motor and mounted on a barge is used by the Moulton Irrigated Land Company for delivering water to rice fields along the Sacremento River, California. As the barge is towed from point to point by a gasoline launch, it is able to accomplish what would otherwise require four stationary plants. Power is obtained at the four pumping stations from the 11,000 volt transmission line of the Pacific Gas & Electric Company. A bank of transformers on the barge steps down this tension to 440 volts as used by the motor. About 16,000 gal. per minute are handled by the pumps, and as the head varies from 12 to 23 ft. with the river stages the motor is about 30 per cent. overloaded when the river is at its lowest point. So far, it is reported, no trouble due to this overload has been experienced. The outfit is operated almost continuously from the latter part of April to the end of August, being shut down only when the barge is towed from one point to another.

Another ten-storey building is to be erected in Montreal. It will be constructed on St. James street, for the Marcil Trust, from designs by E. and W. S. Maxwell, the estimated cost being $350,000. The building will be 130 feet high, with a frontage of 78 feet and a depth of 104 feet. The frame is to be of steel, and the exterior of granite up to the first floor, the remaining portion being of artistic terra cotta. The cornices will be of granite and terra cotta. The architects have designed a fire-proof building: the foundations will be of reinforced concrete on the Kahn system; the floors will be of the same material, and the stairs of iron with marble treads. Marble will also be employed in the entrances, and the interior will be finished in mahogany. A small refrigerator plant will be installed for the purpose of supplying ice water to every office. Three elevators are to be put in.

The Design of Large Bridges, With Special Reference to the Quebec Bridge—Part I

By Ralph Modjeski, Consulting Engineer, Chicago

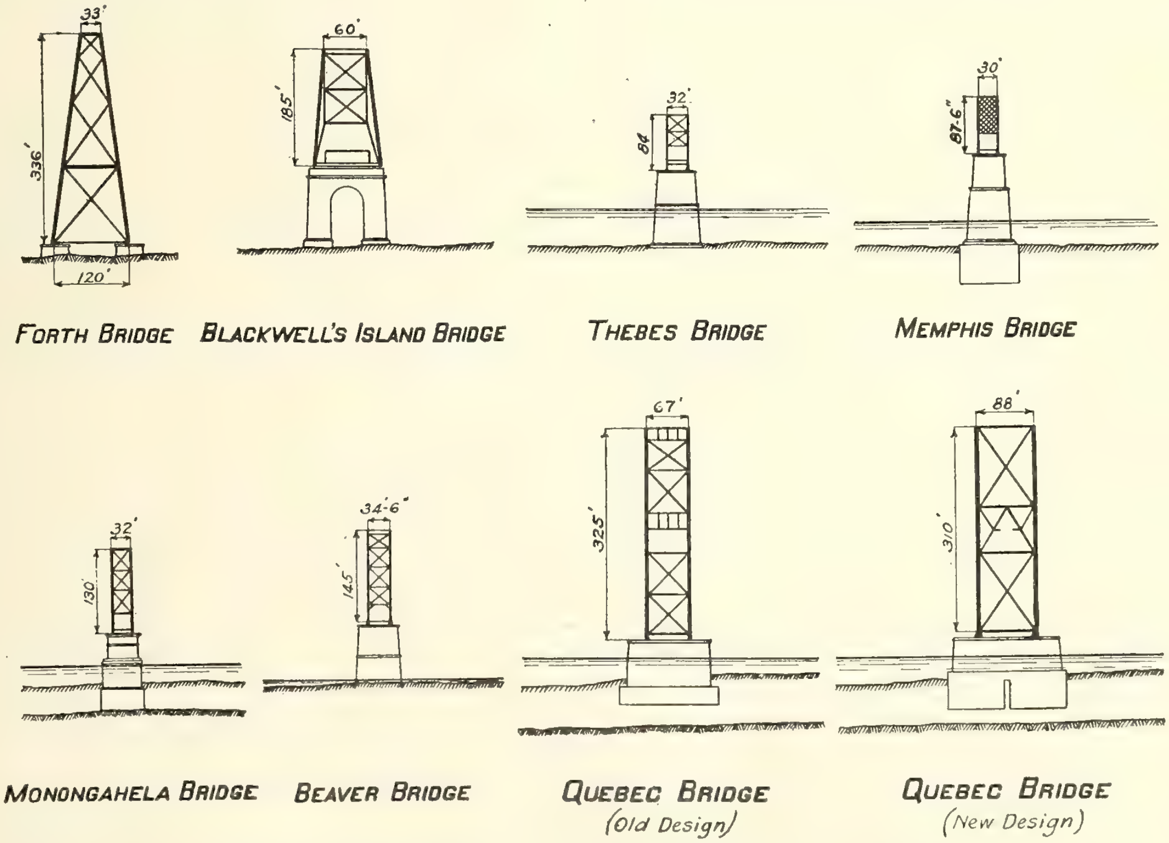
SOME of the more important questions to be considered by the designer of large bridges and the propriety of selecting the location not only to secure a favorable site for construction but also to make the bridge most efficient in relation to traffic, which may justify a more costly structure at one place than at another point where its location would involve disproportionately increased operating expenses, are the principal factors emphasized in the paper presented before the Mechanical and Engineering Section of the Franklin Institute, which is reprinted below in the slightly condensed form arranged by The Engineering Record. The permanency of the river bed and the character of the foundation are also very important considerations which should be thoroughly investigated.

Length of Spans

Where no limitation is placed by the Government as to length of all spans, the spans should be made of economical length, provided the piers do not reduce the cross-section of the river sufficiently to cause an undesirable increase in the current velocity. This economical length may be determined by trials, and will be attained approximately when the cost of the superstructure and of the substructure are nearly equal.

In the case of the Quebec Bridge, while the navigation interests fixed the clear height of the structure above high water at 150 ft., the length of span is entirely due to the physical conditions of the crossing. The stream at this point is narrow and deep, the depth in the center of the stream being about 190 feet. The current velocity at ebb tide is very high—about 9 miles an hour. Very heavy ice runs at times and tends to gorge. The bed rock, as shown by the borings, while accessible near the shore lines, dips rapidly toward the center of the stream. All these conditions made it imperative to build a span of great length. The information as to bed rock which we now have would indicate that the original project could have been designed with a somewhat shorter span. Yet we should remember that this original project was undertaken by a private corporation, and we should perhaps recognize the value to it of such advertisement as the building of the longest span in the world would obviously afford. The next longest span is that of the Fifth of Forth Bridge, and is 1,700 ft. long. It is doubtful if a shorter span than 1,700 feet would have been practicable at the location adopted for the Quebec Bridge. I consider it perfectly legitimate to build a more expensive structure than economy of the work itself would call for, if the more expensive structure will afford sufficient advertisement and publicity to compensate for the additional expenditure. Cases also often arise where a purely economical and utilitarian structure would be entirely out of harmony with the surroundings.

A project to build a large bridge at Quebec, pre-



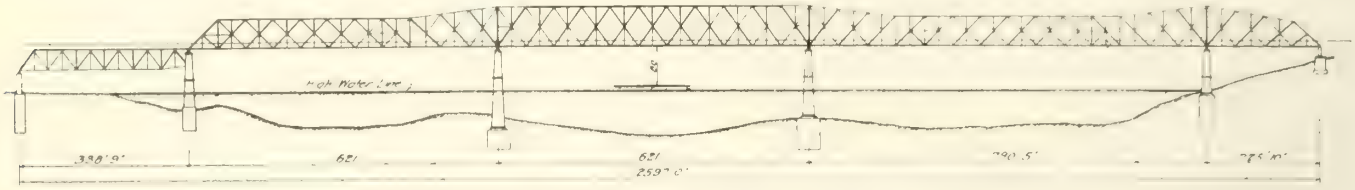
FORTH BRIDGE BLACKWELL'S ISLAND BRIDGE THEBES BRIDGE MEMPHIS BRIDGE

MONONGAHELA BRIDGE BEAVER BRIDGE QUEBEC BRIDGE (Old Design) QUEBEC BRIDGE (New Design)

Main pier vertical posts or towers for longest cantilever spans.

sumably in the same location as the present one, was seriously considered in 1884 and 1885. Messrs. James Brownlee, A. Luders Light, and T. Claxton Fidler designed a structure with a clear span of 1,442 feet. The description of that project mentions rock foundations. The more complete information we now have, and which was obtained by a costly series of borings, shows that at the present location rock could not have been attained in both piers with any known method of foundation if the piers had been spaced only 1,442 feet apart, even if the great depth of water could have been overcome.

It may be remembered that after the disaster of August 29, 1907, the Dominion Government took up the reconstruction of this bridge. A board of three engineers, including myself, was appointed to design and construct the bridge. After some study of the situation, the board decided that the new bridge should be made wider between trusses and designed to carry heavier loads than those originally contemplated; that, further, none of the old steel work could be used to advantage. It also decided to keep the same location. The final outcome is a double-track span 1,800 ft., with a width of 88 ft. between centers of trusses, designed to carry on each track a live load consisting of two E 60 engines placed in any position in a train weighing 5,000 lb. per foot so as to produce greatest strains. The old piers were not large enough for the new design and could not, therefore, be used. At first the board contemplated building an entirely new pier 57 ft. south of the present north pier, and enlarging the foundation of the south pier by sinking additional caissons adjacent to the old caisson. The necessary span length would then have been 1,758 ft., and it was on that length of span that tenders were asked. It developed later, from the experience of sinking the north caisson, that the method proposed for enlarging the south foundation would not be safe, even if it were practicable, and so an entirely new foundation and pier were decided on for the south shore. The new north pier could not be placed farther out in the river because of the sloping bed rock and great depth of water. The south pier could not be placed on the north, or river, side of the old south pier because of the old wreckage, so it was placed 64 ft. 8 in. south of the old pier, or as close as possible to it. Both new piers being placed 64 ft. 8 in. south of the old piers, measured between centers, the new span remains 1,800 ft. long.



Memphis Bridge, Memphis, Tenn.

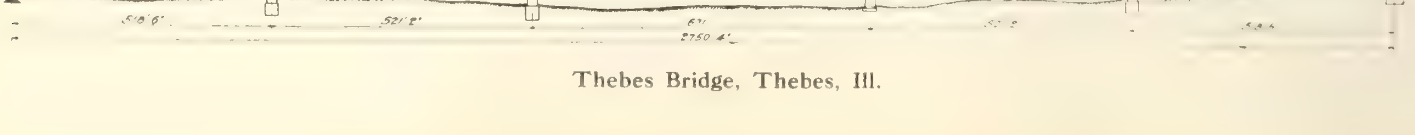
Substructure

The piers are all of granite backed with concrete. There is an increasing tendency now to build everything of concrete. Certainly, concrete is a most convenient material and quite economical. When it comes, however, to providing supports for a very important and expensive structure, cut-stone masonry should be used in preference to concrete, except for backing. There are many varieties of excellent building stone on this continent. I have used granite, some varieties of oolitic limestone, also sandstone, which all show excellent lasting qualities in works constructed many years ago, while concrete present some uncertainties and requires expert care to give good results. Concrete may in ages prove to be as lasting as stone masonry, but as yet we do not know. We know that well-constructed stone masonry will last for centuries. A notable example of this is the great Aqueduct of Gard, built by the Romans in the first century B.C.

Types of Superstructure.—Having fixed the span lengths of a bridge, the next thing to determine is the type of superstructure to be used. The various types usually applied to long spans may be classified as follows: (1) Arches (steel)—(a) three-hinged; (b) two-hinged. (2) Simple spans. (3) Cantilever structures —(a) with suspended span; (b) without suspended span. (4) Suspension bridges.

I have purposely omitted masonry and concrete arches as structures not coming clearly within the scope of this paper. Steel arches have a rational application only where Nature has provided natural abutments, as at Niagara Falls, for instance, or where natural surroundings lend themselves to ornamental construction.

Crooked River Arch.—I have recently completed an arch bridge for the Oregon Trunk Railway in the Crooked River Canyon. It is a two-hinged spandrel braced arch. Three-hinged arches are now seldom used for a railway bridge because they are less rigid than two-hinged arches. They still have a good application in roof trusses which are not subject to heavy and rapidly moving loads. In several large arch spans the central connection offered considerable difficulties. The reason is that the top chords at the center of a purely two-hinged arch are calculated to have stresses in them, due to dead load and temperature, when the span is rivetted up and ready to receive the rolling load. These stresses had to be introduced by powerful jacks, or other means, before the final point could be rivetted up. To avoid this difficulty, I have proceeded as follows in the Crooked River arch. It was assumed that the dead load and temperature stresses at 60 deg. Fahr. in the top chord at center are zero. This being the case, the arch acts as a three-hinged structure under those conditions—namely, with all



Thebes Bridge, Thebes, Ill.

dead load in place and at 60 deg. Fahr. The span was, therefore, erected as a three-hinged arch, all dead load, or the equivalent, including the decking, was placed thereon, and at a time when the temperature was very nearly 60 deg. the center panel of the top chord was inserted and rivetted up. The calculations were simple. The dead-load stresses were calculated as in a three-hinged arch, the temperature and live-load stresses as in a two-hinged arch, and the various results combined.

Type of Span

A two-hinged spandrel braced arch is probably the best type to use for railway traffic, where the natural abutments permit of sufficient rise, which will often be the case where the arch type or bridge is a logical solution. This particular type of arch is more rigid and less subject to vibration than the other types of arch, and presents the advantage of easier erection, which can then be simply performed by treating each half as a cantilever arm held back by suitable temporary anchorages until the center connection is made. An arch bridge is a somewhat special structure and is rarely used for long spans, except, as I remarked before, where Nature has provided abutments.

Simple Spans.—Twenty-five or thirty years ago the system of truss most favored for long simple spans was a double intersection Pratt truss with parallel chords. Nowadays the type most used is a single intersection Pratt truss with subdivided panels and curved top chord. The curved top chord is an element of economy. The single system has also a slight advantage of more definite stresses. It has its disadvantages, such as, for instance, the lack of uniformity in deflection, about which I will speak more in detail in connection with cantilever system. There is no doubt that a bridge composed of simple truss spans is a better bridge than a cantilever system or a suspension design, chiefly because of its rigidity. This rigidity results from the fact that a load placed on one span has no lifting action on the adjacent spans, as in a cantilever system, or on other portions of the same span, as in a suspension bridge. But long simple spans must be erected on falsework or floated into position. The first method is often inadmissable on account of the necessity of keeping the channel open for navigation or excessive depth of water combined with navigation requirements, or other local conditions. The floating of a span into position is not only costly but hazardous. It has been successfully performed, but is not always feasible or safe. Then, too, generally speaking, a cantilever bridge is more economical for long spans. These considerations often lead to the adoption of a cantilever design in preference to simple spans. A cantilever span can always be erected without falsework, although the adjacent or anchor spans must generally be erected on falsework. Sometimes simple spans are erected without falsework.

The length of simple spans has been growing from year to year. It may be remembered that the Cincinnati Southern Bridge at Cincinnati, built in 1877, contains a simple span of 515 ft. In 1891 Mr. George S. Morison built the Cairo Bridge, connecting a span 518 ft. in length, single track. The Municipal Bridge in St. Louis has three simple spans of 668 ft. in length, 110 ft. high at the center, double track and roadways. The Metropolis Bridge over the Ohio River, if the present design is carried out, will have a simple span 720 ft. long, double track. This increase is due largely to the use of higher grade materials, such as nickel or chrome-nickel steel, and to the improvement in shop and field methods.

An here we may say a few words about wind forces. In small spans the action of wind rarely affects the main members of the span, and the wind bracing used is calculated more to make the structure rigid against lateral motion under rapidly moving loads than to take care of actual wind stresses. As the length of span increases, this element of wind becomes more and more important, until in very long spans it may become as important as the moving load. In a simple span the heaviest members, as well as the greatest height of truss, occur near the center of the span. In other words, the resistance to wind per lineal foot of truss in a simple span is greatest at the center of the span, and, owing to the overturning moment due to wind, grows in importance with the height. In a cantilever span the greatest height of truss and the heaviest members are near the piers, hence the greatest resistance to wind per lineal foot of truss is near the piers. This remark is sufficient to explain why wind stresses are easier to provide for in a cantilever structure than they are in a simple span of the same length.

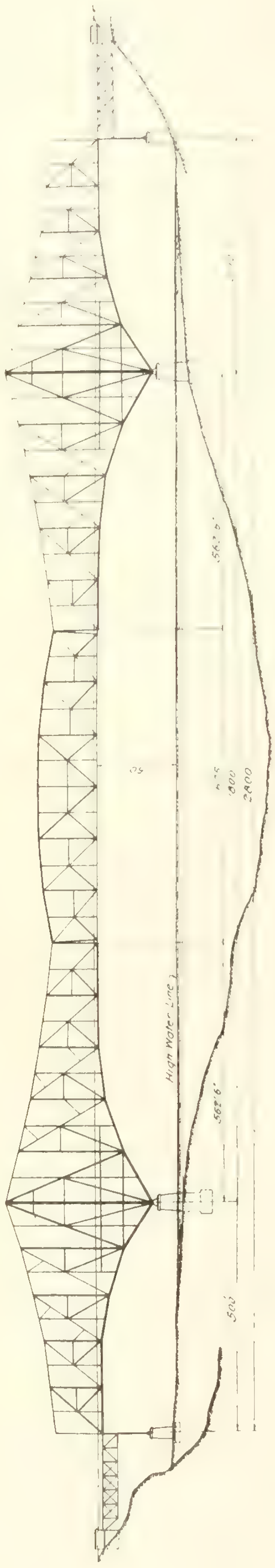
PROPORTION OF SINGLE SPANS WITH CURVED TOP CHORDS

	Per cent ratio height to length	Per cent ratio width to length
Municipal Bridge, St. Louis, Mo.	16.47	5.24
Cincinnati, Ohio, over Ohio River	15.41	5.60
Pennsylvania Railroad, over Deleware, Phila.	15.76	5.82
Ohio Connecting Railway, Pittsburgh	14.53	5.57
McKinley Bridge, S. Louis, Mo.	15.07	5.73
Merchants Bridge, St. Louis, Mo.	14.47	5.80
Mobridge, Mo.	15.18	5.48
New Brunswick Bridge, N. D.	16.25	5.50
Quebec suspended span	17.19	....
Thebes suspended span	15.03	....
Average	15.56	....

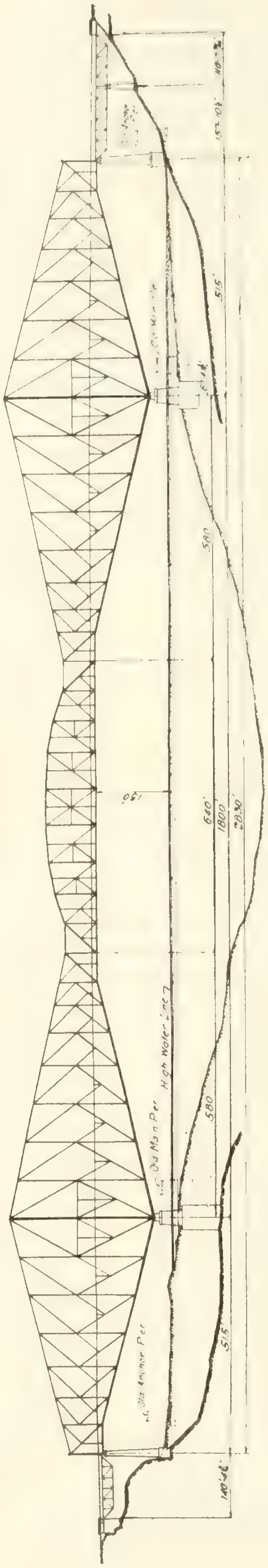
Longest Simple Span.—No hard-and-fast rule can be laid down as to the length at which a simple span becomes uneconomical as compared with a cantilever span. Generally speaking, considering the present knowledge of materials, a simple span of 700 ft. may be taken as the practical economical limit, beyond which it is not advisable to go without a thorough investigation and comparison with a cantilever system. Where conditions require unusual methods of erection this limit may be much lower. For instance, in the Thebes Bridge it was necessary to erect the 671-ft. channel span without falsework. A simple span would have required the addition of a considerable amount of metal, both in the span itself and in the adjacent spans, to permit of its being erected as a cantilever; this excess of metal would have been useless after the completion of the bridge, and its cost would have made the bridge more expensive than the adopted cantilever design.

Dimensions of Simple Spans.—In designing long simple spans the following general principles should be observed. The width, center to center, of trusses should not be less than one-twentieth of the span, preferably one-eighteenth. In double-track spans the width required for clearance generally governs, except in very long spans. The height at center of span, for a Pratt system of truss with subdivided panels, should be from one-seventh to one-fifth of the length.

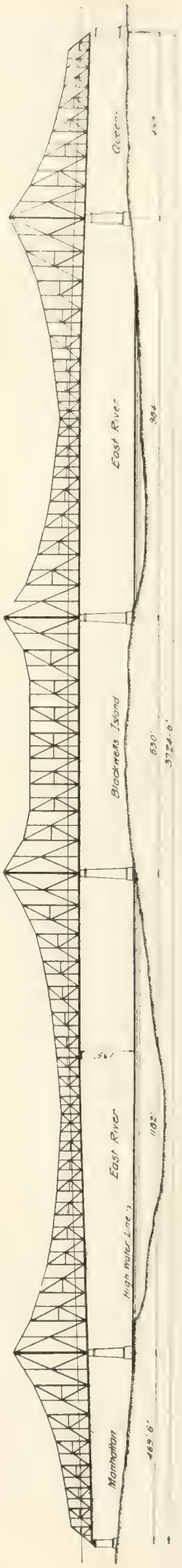
The height at the ends should be only sufficient for



Quebec Bridge (old design), Quebec, Que.



Quebec Bridge (new design), Quebec, Que.



Blackwell's Island Bridge, New York, N. Y.

an effective portal. A rigid mathematical research by Mr. Joseph Mayer, principal assistant engineer of the Quebec Bridge, leads to a theoretical proportion between the height at center and length of span equal to 0.18, or somewhere between one-fifth and one-sixth, for heaviest loads and double-track spans.

Panel Length.—The best panel length is not so easy to determine. Since the economical inclination of diagonals is very nearly 45 deg., it would result that in a Pratt truss with subdivided panels their length should approach one-half of the height of truss. This would mean that in a truss with a curved top chord the panels in the center should be longer than those near the end. This has been done at least in one instance, namely, in the Municipal Bridge in St. Louis. The advantages of such an arrangement are a slight economy in the weight of steel and an improved appearance, since the diagonals have nearly the same inclination throughout. The equal panels, however, present, in my opinion, two decided advantages, which may more than offset the advantages of the former system, namely, that, all panels being equal, there is a greater duplication of parts, the floorbeams are all alike, except at ends, the stringers are all alike, the length of bottom chord eyebars is the same throughout; and, further, that the falsework may be built in uniform panels, and the traveller, which is usually designed with a view to have the uprights in proper relation to the panel points, so that the connections may easily be made, preserve its relation to the various panels points as it is moved from panel to panel. For these reasons uniform panels should be preferred in the majority of cases of simple spans.

I have stated that the greatest practical length of a simple span is about 700 ft. With the use of certain known alloys of steel of greater strength than medium carbon steel this limit may become as much as 750 ft. Beyond this limit the weight of simple spans becomes so great, in comparison with cantilever spans, that the latter must be considered. A mistaken idea sometimes prevails that the weight of steel in a span increases in proportion to the square of the length. This is, in a measure, true for short spans, say 100 to 300 ft. This ratio of increase, however, is not a constant, but increases with the span. A simple span above 1,200 ft. in length increases in weight approximately as the cube of the length, and this exponent increases more and more rapidly until at about 2,000 ft. weight of carbon steel required to carry the weight of such a span and of a moderate live load becomes infinite. For a span built of nickel steel the weight becomes infinite when the length reaches 2,700 ft. Simple spans much below those limits, even if possible, would still be very uneconomical until we get down to spans 700 ft. or under.

Cantilever Spans.—This leads us to cantilever spans. I mentioned two types of such spans—one without a suspended span and the other with a suspended span. A remarkable example of a cantilever bridge without a suspended span, which may be called a semi-continuous structure, is the Blackwell's Island, also called the Queensboro Bridge, in New York. There seems to be no advantage in omitting the suspended span; on the contrary, the structure differs from a truss continuous bridge over several supports only by the introduction of a hinge at the center of the main span which transmits shears but not moments. The vibrations and deflections of each segment are, therefore, transmitted through those hinges to all the other segments. Furthermore, since the stresses in such a structure depend on deflections, there is more or less uncertainty in the calculations. I do not wish to be understood as objecting to any type of structure seriously, because of the uncertainty of calculations. In any logical construction the calculations can always be made with sufficient accuracy for the safety of the work. It is only when everything else is equal that determinate stresses should be preferred.

Let us consider the usual type of cantilever bridges, the one in which two cantilever arms support a suspended span. We may assume that in bridges requiring the construction of a cantilever span the length of the main spans is usually determined by local conditions. The general dimensions to be fixed by the designer are, therefore, the length of the suspended span, the length of the anchorage spans, when these are not determined by local conditions, the height of the trusses at various points and the relative distances and positions of trusses to one another. Let us discuss these various dimensions in connection with the new Quebec design. The Quebec Bridge, with its longest span in the world, has justly attracted much attention among engineers and has naturally elicited comment and criticism. It is acknowledged that a discussion of a scientific subject by professional men is often of greater value than an elaborate paper on this same subject by one individual. If I refer to some of the criticisms, let it be considered as a friendly discussion which may be of value to the profession.

New Quebec Bridge

The new Quebec Bridge has been finally designed with two anchor arms 515 ft. long, a suspended span 640 ft. long, and two cantilever arms 580 ft. long. The moving loads finally adopted for the Quebec Bridge are: On each track two Cooper's Class E-60 engines, followed or preceded, or followed and preceded, by a train load of 5,000 lb. per foot per track. In addition to the actual dead load of the structure, a load of 500 lb. per lineal foot on suspended span and 800 lb. on balance of bridge was allowed for snow.

Wind Loads.—The wind loads were taken as follows: A wind load normal to the bridge of 30 lb. per square foot of the exposed surface of two trusses and one and a half times the elevation of the floor (fixed load), and also 30 lb. per square foot on travellers and falsework, etc., during erection.

A wind load on the exposed surface of the train of 300 lb. per lineal foot applied 9 ft. above base of rail (moving load).

A wind load parallel with the bridge of 30 lb. per square foot acting on one-half the area assumed for normal wind pressure.

In the Forth Bridge the enormous wind load of 56 lb. per square foot was assumed. This load was imposed on the designers by the Board of Trade soon after the Tay Bridge disaster. The Tay Bridge was not designed to withstand even a 30-lb. pressure. This assumption of a 56-lb. wind in the Forth Bridge results in a very large addition of metal in the bottom chords through which the wind stresses are transmitted to the piers. The material in those members is distributed as follows:

	Gross tons
Dead load	2,282
Live load	1,022
Wind load	2,920
Total	6,224

The metal here provided for the wind is nearly three times that provided for the live load, and is about 47 per cent. of the total required.

In the new Quebec Bridge design the wind pressure is equivalent to about 35 per cent. of the uniform live load near the piers and to about 20 per cent. of the live load near the ends of the cantilever arms.

A pressure of 30 lb., according to German experiments with electric cars, would correspond to a wind of a velocity of over 100 miles per hour. Other experiments made at various times on small surfaces show that a velocity of 85 miles would correspond to a pressure of about 30 lb.

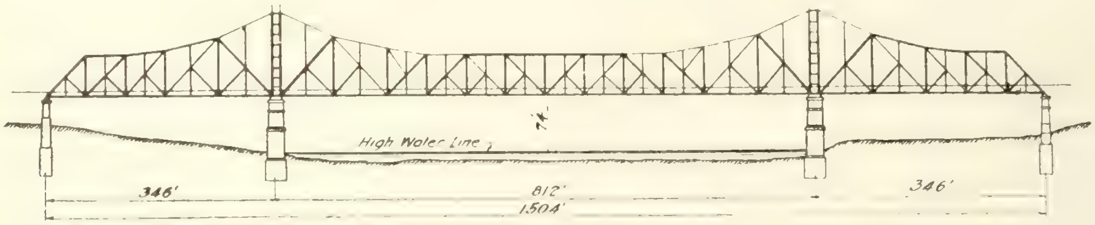
The following formula for wind pressures is generally used: $P = kv^2$, in which P = pressure per square foot, v = velocity in miles per hour, and k = a coefficient.

Eiffel's two hundred or more experiments show this coefficient to vary from 0.0026 to 0.0032, and the average is 0.0030, which he recommends. Trautwine makes $k = 0.0050$, which seems too high. But, even using the latter, a pressure of 32 lb. would correspond to a "hurricane" of a velociey of 80 miles. The German experiments agree with Eiffel's. Making $k = 0.0030$, a pressure of 30 lb. would correspond to a velocity of 100 miles per hour, which, according to Trautwine, is a violent hurricane uprooting "large trees."

With a wind of this velocity there would be no traffic on the bridge—empty freight cars or even light passenger cars would be overturned. Velocities of more than 85 miles may occur in cyclones and tornadoes over restricted areas. Such storms are very rare in Canada; but even should such an extraordinary disturbance happen, causing a wind pressure of as much as 60 lb. to be applied to the entire Quebec Bridge as now designed—the stresses in the truss members would be less than with the maximum live load and a 30-lb. wind—and although the stresses in the laterals would be increased above the specification limits, they would still remain within the elastic limit of the members.

Length of Suspended Span.—The length of the suspended span does not depend merely upon the most economical distribution of material required for carrying the live loads and the dead load of the bridge after it is completed. Where there are no other considerations beyond the actual working stresses in the finished structure, the most economical length of the suspended span for a total span of 1,800 ft. would be in the neighborhood of 1,000 ft. But to erect a simple span of such unprecedented length, either by floating or by cantilever method, would be impracticable. Furthermore, the cantilever method of erecting a suspended span of even a moderate length always requires additional material, both in the cantilever arms and in the suspended span, to take care of the erection stresses.

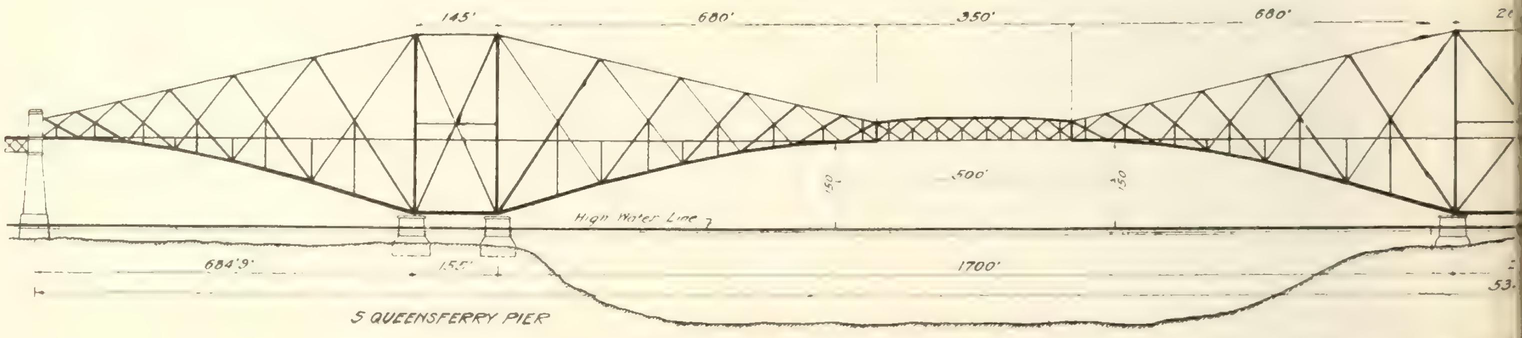
The longer the suspended span in relation to the total main span, the greater will be the required addition—so that whether it be contemplated to erect the suspended span by cantilever method or by floating into position, the length of the suspended span finds itself limited not by mere economic considerations of the finished bridge, but by either the excess of material required during erection by cantilever method, and difficulties arising therefrom, or by the difficulties attending the floating of a very long and heavy span into position. These difficulties increase very rapidly with the length of the span to be floated. In the new design the suspended span is the longest which the board considered safe to float, and it fits the entire design very well.



Monongahela Bridge, Pittsburg, Pa.

Erection by Floating

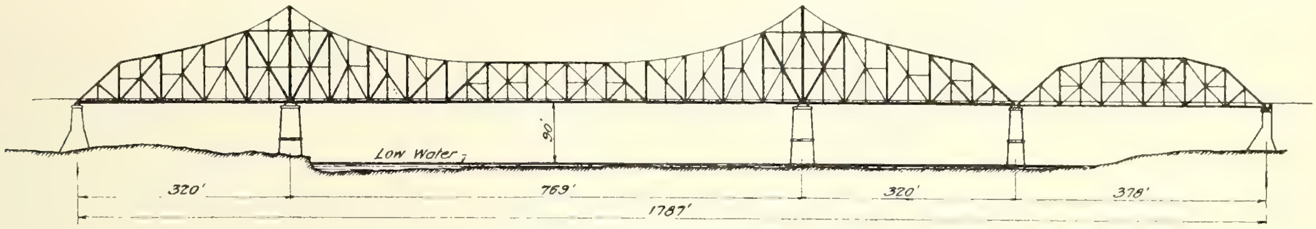
The erection of this span by floating made it possible to design it with the view to greatest economy. Its various members will not be subjected to any greater stresses during erection than they would be in a simple span of the same length resting on two piers. It was, therefore, possible to design it as economically as to weight as a well-designed simple span would be. It is more important to save weight in a suspended span than in an independent simple span, because each pound in the former requires several pounds in the entire structure to carry it. The importance of eco-



Inchgarvie pier, Forth Bri

nomy in the suspended span of the Quebec Bridge will be appreciated when it is considered that one pound uniformly distributed over the trusses of the suspended span needs 3 lb. of metal added to the bridge to carry it, making an addition of 4 lb. in all. This accounts for curved top chords in the span in question, as well as for the use of nickel steel for the trusses thereof.

Length of Anchor Arms.—It has been pointed out that the length of the anchor arms is uneconomical—that a shorter arm would have been cheaper. It must not be forgotten that a shorter anchor arm increases the pier reactions, as well as the steel in the anchorage proper. The present anchor piers are founded on rock ledges which dip rapidly toward the river. To move them nearer to the river would have involved much more expensive foundations.

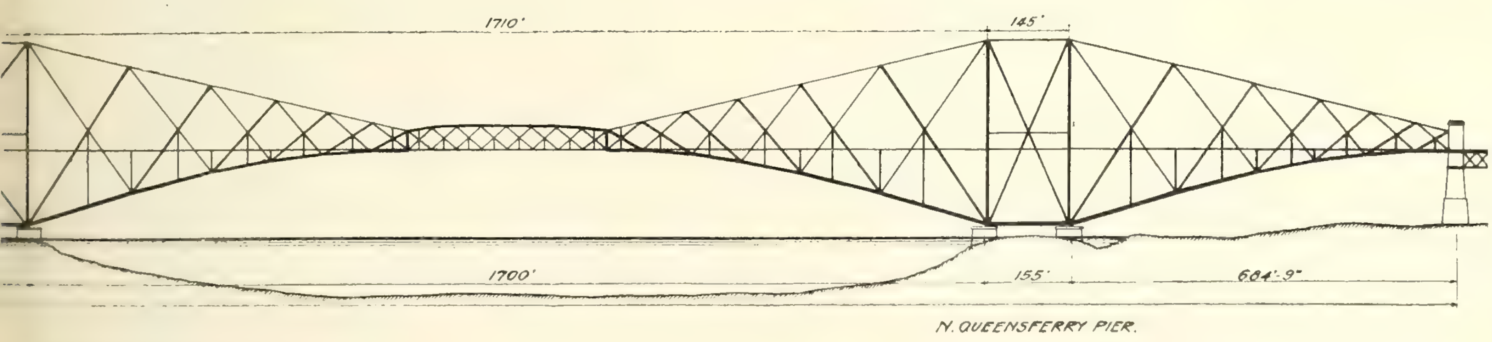


Beaver Bridge, Beaver, Pa.

It may be remarked here that, while an addition of dead load in the main span will require several times the weight of metal to carry it, an addition of dead load in the anchor arm requires no increase of metal to carry it when there is an upward or negative reaction on the anchor pier. This is explained by the fact that any load placed between the main piers or on the main spans increases all moments and shears over all the spans, while any load placed on the anchor arm, if the reaction on the anchor pier is negative, decreases that reaction and consequently the moments in the anchor arm, but has no effect whatever on the main span. For this reason carbon steel will be used mostly in the anchor arm of the new design. The carbon-steel unit stresses adopted for the Quebec Bridge are generally five-sevenths of the nickel-steel stresses, the former requiring heavier members. This additional weight in the anchor arms is a source of economy when the relative prices of carbon and nickel steel are considered.

Height Over Piers.—An opinion has been expressed that the height over the piers of the new Quebec Bridge is not great enough for economy. Actual calculations show that for economy the height of 310 ft. in the Quebec design is too great by about 20 ft. for the "K" system of trussing adopted; further, that this height would have been at least 40 ft. too great for the original system of the official design. The height of the Forth Bridge towers, while 26 ft. higher than the Quebec Bridge, though the span is 100 ft. shorter, is no doubt economical for the form of trussing adopted for it. The economical height is not only a function of the length of the span but also of the panel length next to the pier. This height should be such as to correspond to an inclination of the diagonals not far from 45 deg. A double-intersection system with very long panels near the pier, such as adopted in the Forth Bridge, would have been economical for the Quebec Bridge, except that it requires a system of secondary members or sub-posts, or very heavy longitudinal girders, or both, to carry the load from panel to panel. Then, too, it is well to reduce in the members the stresses due to their own weight—which in long panels become quite important. The 20-ft. excess in height of the present Quebec design over what would have been the economical height is justified by the resulting reduction in the sections of the bottom chords, which are of considerable size at best.

Straight versus Curved Chords.—In long cantilever spans the bottom chords of the cantilever and anchor arms should be straight when possible. With a curved chord the joints must be made at the panel points. These joints are of great importance, as has been shown in the report of the Royal Commission on the Quebec Bridge disaster. They should be fully spliced to take care of secondary stresses due to deflections of the span during erection and under the action of live load. It is advisable, therefore, to place them outside of the point of connection with the diagonals and keep them clear of gusset plates. The same objection does not exist in top chords of simple spans, which are of moderate sizes, even in the longest spans known. The economy in simple spans resulting from such curved chords is worth while and quite important, while if any economy were to result from curving the bottom



near Edinburgh, Scotland.

chord of the cantilever and anchor spans, such economy would certainly be of little importance in comparison with the resulting disadvantages. The vertical deflections from live loads are not as great in a straight chord design as in a curved chord design.

Another consideration in favor of the straight chords is that the most important, in fact the bulk, of the wind forces travel to the pier through the bottom chords of the cantilever and anchor arms and the wind bracing, or lateral system situated in their plane. The straight bottom chords carry these stresses direct to the piers without transmitting any appreciable components to the web system of the trusses. Not so with curved bottom chords. At each point where the chord's direction is changed a component stress is transmitted to the web. This means that while a pair of straight chords with its lateral system deflects under the action of the wind in the plane of the chords only, a pair of curved chords, by transmitting shear to the web members, causes the trusses to deflect, the windward truss downward, tending to flatten the curve, and the leeward truss upward, tending to make the curve pronounced. The rigidity of the straight chord design against lateral deflections and oscillations is therefore greater than that of the curved chord design.

One of the reasons why curved bottom chords were used in the cantilever arms of the original Quebec Bridge design was the fact that it was the aim of that design to provide full headroom of 150 ft. on a width of 1,000 ft. The bottom chords of the anchor arms were then made curved also for the sake of symmetry. The width on which the full headroom will be obtained has been reduced in the new design to about 760 ft., which certainly is more than ample to accommodate navigation. Only the highest vessels will be limited to this width of 760 ft., and that only at high water.

The top chord of the Quebec Bridge cantilever and anchor arms is straight. The Forth Bridge cantilever arms have straight top chords also. While there was good reason for making the Forth Bridge top chord straight, there was no serious reason, beyond a slight increase in vertical rigidity, for making it straight at Quebec. The two trusses on the Forth Bridge are in planes inclined toward each other at the top. The two top chords are parallel. Had they been made curved they could not have been parallel, since they must necessarily be situated in the inclined planes of the trusses. The appearance of tension chords having a greater distance apart at the center of the arm than at either end would have been very bad. But there is no such reason at Quebec. The trusses are in vertical planes and the top chords could have been curved without serious inconvenience, but also without any advantage. The board considered that, aside from the additional vertical stiffness, a straight chord will present an appearance of strength which a curved chord would not do.

(To be concluded)

Retaining walls of molten slag were built a few years ago at the plant of the Butte Reduction Works, Butte, Mont. The forms were composed of cast-iron plates or panels, which were removed as soon as the slag had solidified. Culverts, reinforced with steel bars, were built in the same way. This unusual style of construction was designed by A. H. Wethey, now of New York, and was done to provide for a dump or fill of the tailings deposit from the concentrators, the culverts passing through the fill.

Waterproofing Concrete

ONE of our architectural contemporaries publishes a letter from an industrial company for whom an engine-house roof has been constructed with steel framework and panels of concrete made of crushed furnace slag, sand and Portland cement, and mixed in the following proportions: furnice slag, 4 parts; sand, 1 part; cement, 1 part. The concrete was put on 2½ in. thick, with a layer of expanded metal of 3 in. mesh in the middle, and the upper surface of the roof was skimmed over with a mixture of spar sand and cement. The water got through this, so another layer of about ¾ in. of the sand and cement mixture was laid over the whole surface, but water still got through and cracks appeared all over the roof, especially over the principals. These cracks have been cut out from time to time and liquid cement has been poured into them and afterwards painted over with bitumastic solution. The whole roof has also been painted over with two coats of this, and in spite of all leaks badly when there is any weight of rain.

The writers of the letter seem to think that concrete is an unsuitable material for keeping out water, but the fact that the proportions adopted were such that the concrete could not possibly be watertight, and the idea of trying to make it so by exterior rendering is somewhat humorous. As we have previously pointed out, it is quite easy to prepare concrete of perfectly watertight character by using properly graded aggregate and sand proportioned so that all the voids in the aggregate shall be as nearly as possible filled with particles of sand, by using sufficient cement to ensure that all the remaining voids between the particles of aggregate and sand shall be completely filled. Concrete so proportioned, and carefully mixed, forms a variety of artificial stone absolutely impervious to penetration by water, and which experience has been proved to be not only effective in keeping roofs perfectly dry, but may be used with confidence in the construction of tanks, reservoirs, and pipes where the water is under considerable pressure.—Ferro-Concrete.

Use of Gravel Concrete

Standard gravel concrete specified by the Illinois Highway Commission for general bridge work may be used in place of broken stone and sand in structures built for the State of Illinois. It is to be of three classes X, A and B, proportioned respectively 1:2:3½, 1:2½:4 and 1:3:5.—For Classes X and A all material which passes a ⅛-in. screen will be considered sand and all material which is retained on a ⅛-in. screen and passes a 1-in. screen will be considered stone; but at least 40 per cent. of the stone shall be retained on a ½-screen. For Class B all material which passes a ¼-in. screen will be considered sand and all material which is retained on a ¼-in. screen and passes a 2½-in. screen will be considered stone; but at least 40 per cent. of the stone shall be retained on a 1½-in. screen. In all classes of concrete, if the volume of sand is found to be less than 60 per cent. of the volume of stone, sufficient sand shall be added to bring up the proportion of sand to stone to 60 per cent. If the valume of sand is more than 60 per cent. of the volume of stone, sufficient stone shall be added to reduce the proportion of sand to stone to 60 per cent., or sufficient cement shall be added so that the volume of cement to sand shall be as required.

Requirements of Waterway Structures*

Standard Practice in Wisconsin—Use of Corrugated Metal Culverts Improperly-Designed Foundations Common Source of Trouble

By A. R. Hirst †

AMONG the most important considerations affecting the construction of public roads is that of drainage. The life of every road structure depends upon the draining given it, and the culverts and bridges necessary must be built not only to serve the purpose of drainage, but must serve also the convenience and safety of travel. The failure of a road results only in the additional expense necessary to replace it in proper condition, but the failure of a bridge results also in the suspension of travel, and if it occurs at the wrong moment, may cause considerable loss of property and possibly injury or death to those travelling the road.

For many years both the design and erection of highway bridges was practically entirely in the hands of the steel bridge companies, who used their opportunity to the utmost and decorated the landscape with structures which had little to commend them except the fat prices they brought from an unknowing public.

Within the last few years, however, many states have created highway commissions which have effectually taken up the problem of bridge design and a considerable change for the better has occurred, both in the strength of bridge superstructures and in the foundations, more especially in the latter, which was the place where most of the older structures were especially deficient, if one point of weakness can be selected from the mess of general ineffectiveness.

Requirements of Well-Designed Structure

A properly designed waterway structure should fulfil the following requirements:

1.—Waterway sufficient to carry off promptly the water coming to it.

2.—Proper foundations to bear the loads, resist undermining, and give long service.

3.—Superstructure designed to bear for a long period of years any load which may legally be imposed upon it.

4.—Superstructure wide enough and so constructed as to serve the comfort and convenience of travel.

5.—Economy of maintenance.

A sixth factor, that of aesthetic design and fitness of the structure to the surroundings, has been and is little considered in bridge and culvert design, but will probably be demanded more and more as public appreciation of the value of pleasing design grows.

In the short compass of this paper we cannot enter into a discussion of bridge design, or give any details of any specific type of structure. We will, however, give some account of our standard practice in the state highway work in Wisconsin, and probably this will be sufficient evidence of our views as to what constitutes a proper waterway structure.

Standard Practice in Wisconsin

Wisconsin is a state aid state, and gives state aid to bridges and culverts as well as to road construction. All waterway structures six feet in span and under, are classed as culverts, and built out of the funds available for the construction of the road. All waterway structures over six feet in span are considered as bridges and must be provided for by separate appropriations, the state paying twenty per cent. of their cost instead of 33 1/3 per cent. as in the case of culverts on roads.

Wisconsin has a drastic bridge law which provides that culverts under 18 inches in span must be so constructed or reconstructed as to stand without planking a load of 18 tons, and waterway structures over this span must be designed, "in accordance with standard engineering practice," to stand a load of 15 tons without planking.

In addition to the duty of designing all state aid bridges and culverts, the state highway commission has imposed upon it by law the duty of approving as to their safety and engineering sufficiency the plans of all bridges constructed with county aid. In the seven seasons of the existence of the Wisconsin Highway Commission and its predecessor in highway work, the Wisconsin Geological and Natural History Survey, we have designed about 1,000 highway bridges of a span exceeding 10 feet for counties, and about 400 bridges exceeding 6 feet in span, and innumerable culverts under this span for the state aid construction. In addition to this, we have approved the plans for probably 300 bridges not designed by our engineers, but simply checked as to engineering efficiency. Actual culvert and bridge construction under our own designs has cost about $2,000,000.

Classification of Bridge Superstructures

We may roughly divide our bridge superstructures into five classes as follows:—

Class 1—Spans from 18 inches to 10 feet.—Almost invariably constructed of reinforced concrete of the slab type. We are building even the smallest culverts of reinforced concrete, as we find in Wisconsin that they are entirely serviceable, easily constructed, and in probably fifty per cent. of the cases cost less than any other type of culvert except wood, which is not allowed on any of our work. The smallest concrete structure we are now building is 18 in. x 12 in, as we have found the smaller sizes equally as expensive and very easily blocked with ice and debris.

In some cases, where the foundation conditions are extraordinarily soft and difficult, or concrete materials are not reasonably available, we use culverts of corrugated metal with concrete or stone end walls, but such culverts are used only where it is impracticable to use concrete, and probably not one per cent. of our culverts are now built of this material. Vitrified clay is not used at all on state aid work, as they have been found almost invariably to crack by filling and freezing. Concrete pipes molded in place and afterwards moved to the job are not used for the same reason. Under conditions favorable to their use, both make excellent culverts, and we could recommend them in less severe climates. Cast iron water pipe has not been used on account of its cost, which invariably exceeds that of concrete.

We find in the small concrete culverts from 18 inches to 10 feet the average cost per cubic yard complete, including the excavation and back-filling, is about $8.00, and very seldom runs above $10 per cubic yard; sometimes as low as $6.

Class 2—Spans from 10 feet to 40 feet.—Either reinforced concrete, the slab type up to 18 feet and the through girder type up to 40 feet, or I-beam structures with concrete floors are used. We are building many true reinforced concrete bridges, but with public lettings open to any bidder, the workmanship and finished appearance has been so poor in many cases that we are using more I-beam structures than we otherwise would. In the case of I-beams, a five inch concrete floor is placed on top of the I-beams, and the corrugated arch type of support for the concrete between the I-beams is but seldom used.

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† State Highway Engineer of Wisconsin.

Class 3—Spans from 40 to 80 feet.—We are using the Warren rivetted pony truss practically exclusively, though a few plate girders are being used where the conditions of hauling are favorable. All of these structures have concrete floors.

Class 4—Spans from 80 to 135 feet.—We use the rivetted Pratt high truss with a horizontal top chord, also with a reinforced concrete floor.

Class 5—Spans over 135 feet.—We use a Pratt rivetted high truss with a curved top chord. Practically all of these larger spans are also built with a reinforced concrete floor. Very seldom do we use a pin connected truss, either for Class 4 or 5, probably not once in twenty-five cases.

From our cost figures on all bridges so far constructed, we find that for any span the price erected (including substructure and superstructure) figures out very closely to $40 per linear foot of the over-all span. Reinforced concrete floors average about 20 cents per square foot. Steel in plate girder and truss spans averages from $65 to $70 a ton erected, and I-beam spans figure from $50 to $60 a ton erected.

We have adopted for widths for concrete culverts and bridges the standards recommended by the Association of State Highway Departments, which are as follows:

First Class Roads

	Feet
Culverts under 12 ft. span, minimum width	24
Slab bridges over 12 ft. span, minimum width	20
All other concrete spans	20
Very long bridges if necessary.	

Second Class Roads

	Feet
Culverts less than 12 ft. span minimum width	20
Slab bridges over 12 ft. span, minimum width	18
All other concrete bridges, minimum width	18

Third Class Roads

	Feet
Culverts less than 12 ft. span, minimum width	20
Slab bridges more than 12 ft. span, min. width	18
Longer bridges may be, minimum width....	16

Steel bridges are built almost invariably with a 16-ft. roadway; that is, 16 feet clear distance between trusses or rails, no matter what the class of road, although for spans under 80 feet some 18 feet clear roadways have been built.

Abutments under practically all structures are plain concrete, as with concrete materials as cheap as we have them in Wisconsin, and with the difficulty of getting first class workmanship in reinforced concrete foundations without constant inspection, we find that this is the cheapest type of abutment. Occasionally common rubble masonry abutments are used, and once in many times driven steel I-beam piles surrounded by a concrete wall are used. The last type of abutment has been found to be very satisfactory and economical for high abutments on sandy bottoms, and has largely displaced the use of cylinders with steel backing. Steel backing is not allowed on any state aid structure. The price of concrete in bridge abutments and piers averaged last year about $8 per cubic yard.

Concerning Foundations

A large share of the trouble with bridge structures results from improperly designed foundations. A common fault is stopping work before a proper depth below stream bed is reached. Seldom should foundations extend less than four feet below stream bed, and whenever doubt as to the bearing power of the soil at that point is entertained, or as to undermining from a rapid stream, they should be carried down to solid soil or thoroughly piled. All foundation work should be inspected as the excavation is made and material is placed, not necessarily by an engineer, but at least by an honest man with good judgment and backbone. All concrete work in any part of the structure should be inspected as it is placed. Inspection of steel and workmanship on it as it is erected is not so necessary, as it can be inspected and its compliance with the specifications determined after erection at the time acceptance is to be given.

Open Competition for Work

As to methods of letting the work. We have found it necessary to have open competition and sealed bids on bridge work, and by asking for mailed bids on all work have established true competition and have to a very large extent broken up the old system of "pooling," and combinations of the bridge agents who may be on the ground at the letting. We furnish complete plans for foundations and for reinforced concrete, I-beams and plate girder spans, and all bidders submit prices on our uniform plans. For truss spans, we furnish the truss diagram showing the stresses in the truss members and the make-up of the truss members, floor system, and principal connections, and the successful bidder submits for approval the shop drawings before fabrication is commenced. For trusses we believe the latter system is preferable to that of furnishing complete shop drawings, as it allows manufacturers to follow their standard shop practice in detailing so long as these details are satisfactory.

The proper design for culverts and bridges is an engineering problem which should always be left to engineers. Probably a state highway department can handle it more economically than can private engineers, as so many bridges will be built of one span that superstructure plans can be standardized and even the same foundation plan may fit several bridges. The cost of designing, letting and accepting bridges in Wisconsin has averaged us about 5½ per cent. of the total cost. Inspection has been paid for separately by the local units. It would probably be better to have a state inspector on each bridge, but we have had very good results through local inspection at probably 25 per cent. of the cost of placing a man on each job. Important jobs should have a skilled inspector, by all means.

Following the repassage of the vote of a million dollars for the site of the Canadian Government buildings in London, three eligible sites are now before Lord Strathcona and the Ministers. One is Westminster Hospital, 26,500 square feet, facing Westminster Abbey, valued by the owners at one and a half million dollars. The Government is not expected to pay any such price, especially as the separate arrangements made by British Columbia, Alberta and other Provinces preclude the realization of the idea of the Provincial Governments being housed with the Federal and sharing the expense. It is understood that Earl Grey's option on the Aldwyche site has been transferred to Lord Strathcona, but many feel that Canada would do best if the headquarters were given a distinction of their own and not crowded up with the Australian. Mr. Griffith, the official Secretary to the Canadian Government, says that nothing is likely to be settled yet awhile, and that Ottawa has no intention of rushing its decision.

The Board of Works of London, Ont., recently decided upon the preparation of the storm sewer and breakwater bylaws for presentation to the vote of the ratepayers at the earliest opportunity. The storm sewer system will cost $400,000. A similar by-law was defeated upon the occasion of its last submission to the ratepayers, but it is expected that no opposition to this by-law will develop as, in the meantime, London has had ample evidence that such a system is an absolute necessity. Until the system is at least well started practically no progress can be made in the matter of building better roads and the need of improved pavements is most urgent. City Engineer Ashplant reported that he could build a good breakwater for West London for $25,000, and the bylaw will call for debentures for only this amount.

Selection of Macadam Road Material[*]

A Matter of Equal Importance with Location, Drainage and Construction—Use of Local Products—Dust Preventives and Binders

By L. W. Page[†]

Of all the factors which go to make up the perfect macadam road, there is undoubtedly none more potent than that of the suitability of the material which enters its construction. A road may be located, drained and constructed along the very best lines and according to the most approved methods and be a total failure if the material of which it is built has been poorly chosen. It is perhaps not too much to say that large sums of money are wasted annually in this country because too little importance is attached to this phase of the road problem. The engineer, then, is confronted at the very outset with the important problem of selecting the most suitable material for his work, and on the care with which he performs this task depends in a large degree the success or failure of the road he is to build. The purposes of the present paper is to discuss in some detail the methods which may be used in aproaching this problem, with special reference to the value of laboratory tests as an aid in the selection of suitable materials for roads.

Methods of Testing

There are two ways in which the engineer may avail himself of the information necessary to a proper selection of a road material. The first and only certain one is to make an actual service test on the material under observation, and under the same conditions of traffic and climate to which the proposed road will be subjected. This method is, of course, impractical except in certain rare instances, due to the length of time which must elapse before definite results can be obtained. The second method is, by means of short time laboratory tests to approximate as nearly as possible the destructive agencies to which the material will be subjected on the road, supplementing the knowledge thus gained by a study of the results already obtained in practice on material of a similar noture.

The laboratory testing of road building materials originated in France over forty years ago, and was introduced into this country by the writer in 1893, when he became Director of the Road Material Laboratory of the Lawrence Scientific School at Harvard University. The United States Government became interested in this work shortly afterwards, establishing, in 1900, a laboratory in the Department of Agriculture, at Washington. This Laboratory is now a part of the Office of Public Roads, and has thus been able to give much assistance throughout the country in regard to the proper selection of material for macadam roads.

The three most important properties which a rock should possess in order that it may successfully resist the destructive agencies to which it is subjected are hardness, toughness, and cementing value.

Hardness, from the road builder's point of view, may be defined as the resistance which a rock offers to the displacement of its surface particles by friction. It is well illustrated in practice by the grinding action of iron tired vehicles which tend to reduce to dust the rock fragments of which the road is composed. This property is determined in the laboratory by a special method, the essential features of which are as follows:

A core 25 mm. in diameter is drilled from a sample of the solid rock by means of a core drill. After being accurately weighed, it is held in a perpendicular position against a cast steel disc revolving at the rate of thirty-three revolutions per minute, while crushed quartz sand of a standard size is fed upon the disc to act as the abrasive agent. After one thousand revolutions of the disc, the core is again weighed, the loss calculated, and a measure of the hardness of the rock thus obtained.

Toughness, or resistance to impact, is a measure of the ability of a road material to resist the pounding action of traffic such as is caused by the shoes of horses, etc. It is determined in the laboratory in the following way:

A cylindrical test specimen of the rock 25 mm. by 25 mm. is taken from the core used in the hardness test, and subjected to the impact of a two kilogram hammer through a spherical end plunger in a machine especially designed for the purpose. The test consists of a one centimeter drop of the hammer for the first blow, followed by an increase in the drop of one centimeter until failure of the test piece occurs. The height of blow at failure is taken to represent toughness of the specimen.

The combined effect of the mechanical agencies causing wear is very effectively determined by means of the Deval abrasion test, which has been the standard for over thirty years, and which is conducted essentially as follows:

Five kilograms of the rock to be tested is broken so as to number as nearly as possible fifty pieces, and is placed in an iron cylinder, mounted in such a way that the axis of the cylinder is inclined at an angle of thirty degrees with the axis of rotation of the machine. After ten thousand revolutions of the machine at the rate of thirty-three per minute, the material is taken out and sieved through a 0.16 centimeter sieve, the material passing being that used in calculating the percentage of wear.

The cementing value of a road stone is that property which caused the fine rock dust to act as a cement and thus bind the coarser fragments of which the road surface is composed into an impervious shell. A laboratory test to determine this property was devised several years ago by the writer, and is conducted substantially as follows:

Five hundred grams of the material to be tested is broken to about pea size, and placed, together with a sufficient quantity of water, in an iron ball mill. Five thousand revolutions of the mill reduces the mixture to the consistency of a stiff dough, which is moulded by means of a hydraulic moulding machine into cylindrical briquettes 25 mm. by 25 mm. in size. After drying twenty-four hours, these briquettes are tested by impact in a machine especially designed for the purpose. A one kilogram hammer falling upon an intervening plunger, which in turn rests upon the test piece, is allowed to drop from a height of one centimeter until failure of the specimen occurs. The number of blows causing failure is used to represent the cementing value of the material.

It will readily be seen from the foregoing that a very accurate preliminary idea of the properties of a road stone may be obtained by means of laboratory tests. Many years' experience in testing these materials have made it possible to adopt certain standards of excellence which, when used intelligently and in conjunction with the other factors in the case, are of much value in selecting suitable materials for water-bound roads.

The results of laboratory tests alone, however, are not sufficient to judge of the suitability of a rock for road building purposes, unless supplemented by additional information as to , (1) the character and volume of the traffic to which it is to be subjected, (2) climatic conditions under which it is to be used, and, (3) its name and general character, including, if possible, its mineral composition. In addition to the above, consideration in any specific instance should be given to such matters as the availability of the material, especially with reference to cost, transportation facilities, etc.

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[*] Paper presented at the Third American Road Congress, Detroit, Sept. 29-Oct. 4, 1913.

[†] Director U. S. Office of Public Roads, Washington, D. C.

The value of taking these factors into consideration will be briefly illustrated below.

It is a well known fact that a given road rock is far from being equally well suited to different traffic conditions. A high grade trap rock would be as unsuitable as it would be uneconomical on a road subjected to light traffic, in that the dust worn off would not be sufficient to bind the coarser fragments together, and the road would consequently ravel. On the other hand, the comparatively soft limestone which would be well adapted for the light traffic road would quickly pound to dust if subjected to conditions which would hardly affect the trap.

As a general rule, it may be said that the ideal rock for any particular road should be just so hard and tough that the fine material worn off by the action of traffic would be sufficient to supply that lost by the physical agencies of wind and rain. By correlating the information obtained by observing the behavior of the various rock types under different traffic conditions, with the results of laboratory tests on material similar in character, it has been found possible to determine quite definitely under just what conditions any given material would be most suitable, even before it had ever been used in road construction.

Many years of observation of the behavior of the various road building rocks in service has demonstrated the fact that, as a general rule, certain classes of material possess for particular purposes distinctive advantages over others. It is obviously of advantage, therefore, to know the general type of the material under observation, in order that an intelligent comparison my be made between it and material of a similar nature which has already been used. The different varieties of trap, for instance, such as diabase, basalt, etc., are generally considered to make the most satisfactory road material, especially when the traffic is heavy enough to supply by wear the dust lost from natural causes. The limestones, as a class, being softer and less tough are, as a rule, better adapted for light traffic than the traps. Laboratory tests in these cases are, therefore, mostly of value in enabling the engineer to make a definite choice between a number of materials which in a general way might be considered as suitable for his work.

The granites, owing to lack of toughness and cementing value, are, as a rule, only suitable for the foundation courses in plain macadam construction. Here the value of taking into consideration the character of the rock tested may be illustrated by the fact that frequently granites are found by laboratory tests to have good cementing values, due to highly altered minerals, when, as a matter of fact, such material should not be used on account of the ease with which it disintegrates under traffic.

Foliated material, such as gneiss, schist, slate, etc., should never, of course, be used when better material is available. Material such as quartzite and marble should also be avoided, the first on account of its hardness and lack of cementing value, and the second because of its crystalline structure and general lack of durability.

The availability of various materials considered for use in road construction should, of course, be considered, and this is highly important, especially from a financial standpoint. In considering this point, however, care should be taken not to lose sight of the other factors in the case. Experience has shown in innumerable instances where poor material has been used because it was cheap that money would have been saved in the long run by the use of a superior rock, even though shipped from a distance and costing considerably more at the outset. There are cases, however, where local material may be used advantageously. It is in such instances as these that engineering judgment, combined with laboratory results, is necessary for proper selection.

An accumulation of data resulting from the great number of tests made on road building rocks in the Government laboratory has quite recently made possible some very interesting investigations concerning the relation between the properties of hardness and toughness. By plotting numerous values of these tests, it was found that, in a general way, hardness increases with toughness and that, whereas for low values of toughness the hardness was extremely variable, as the rock became tougher the hardness showed less and less deviation from an average of the plotted points. The significance of this fact is that the property of hardness appears to be invariably associated with that of toughness, although the reverse is not the case. It seems, therefore that for a quick determination of the qualities of a road building rock, the hardness test might possibly be omitted, since material which satisfactorily passes the toughness requirement invariably appears to be hard enough for use in road construction.

When rock is to be used in bituminous construction, the importance of some of the above-mentioned tests is diminished. The cementing value, for instance, may be practically disregarded when the use of an artificial binder removes the necessity for dependence upon a dust bond. A tough rock is, of course, preferable, and more especially when the surface is to withstand the shock of heavy traffic, but both toughness and per cent. of wear become less important in the body of the road with bituminous construction when the surface is maintained by occasional surface treatments to preserve a wearing mat with a hard and tough aggregate.

Dust Preventives and Road Binders

Since public health and comfort have universally demanded an abatement of the dust nuisance, and economic maintenance is correlated with their demands, a few words on the selection of dust preventives and road binders can not be out of place in a discussion of materials for macadam roads. The selection of a form of treatment or construction must be governed by a full consideration of the volume and character of traffic which the road surface is called upon to carry. In rural sections where a macadam road is subjected principally to the average farm traffic and a relatively small number of automobiles, a surface which is in good condition at the outset may be economically and satisfactorily maintained by an occasional application of one of the lighter dust laying tars or oils. The purpose in a case of this character is simply to preserve an already good surface by keeping the products of wear saturated with a material that will prevent them from being removed from the road surface. This purpose is really best accomplished by a product that is not possessed of marked binding qualities—a material that will not pick up nor "ball" when mixed with dust only. Hygroscopic salts and other non-bituminous dust preventives have also served the above purpose successfully where climatic conditions favor their particular characteristics.

The value of a simple dust preventive decreases, however, with an increase in the volume of automobile traffic, and a more permanent form of wearing surface then becomes necessary. Up to a certain limit, and particularly on park roads, this character of traffic is successfully provided for by means of an annual surface treatment of oil or tar covered with cleaned screenings or fine gravel. For cold surface treatment, the oils which give particular satisfaction are the natural or partially refined products which, through laboratory tests, are shown to consist of low-boiling constituents carrying in solution a relatively high amount of heavy adhesive asphaltic base. For most successful surface treatment, it is essential that an oil shall develop decided adhesive qualities in the residue from the standard volatilization test at 163 deg. C. Tar products should be free from water,

When the traffic becomes of such a character and magnitude as to cause a too rapid deterioration of a surface mat, the macadam must be constructed or resurfaced with a heavy binder as an integral part of the upper two or three inches of the wearing surface. The selection of a binder, whether it be a tar or asphalt product, now becomes dependent on several factors, among which the method of construction, character of the aggregate, and climatic conditions are most important. For instance, a dense aggregate may permit of the use of a lighter tar than will a poorly graded one; or a lighter tar or softer asphalt product would be specified for northern latitudes rather than for use in the south. A single standard for all materials and conditions can not, therefore, be established, but with the various factors in mind, a specification can be drawn to cover the consistency and desirable chamical characteristics. In fact, in the purchase of road materials for whatever purpose it should be to the advantage of the producer as well as a protection to the consumer, that a definite specification be required. All shipments when received should be submitted to laboratory tests that will insure fulfillment of those specifications.

American Road Builders' Association Congress
New York, December 9-12

Plans for the Fourth American Good Roads Congress, to be held under the auspices of the American Road Builders' Association in the First Regiment Armory, Broad and Gallowhill Streets, Philadelphia, Pa., are being worked out in detail by the Convention Committee and officials having the matter in charge.

The following outline of program shows the subjects to be discussed at this convention:

Subject A—Organization

1. Highway Officials—Their Duties and Powers.
2. Division of Expense, Responsibility and Authority Between the various Municipal and Other Units Participating in a Road or Street Improvement.
3. Relationship of the Contractor, the Chief Engineer, the Resident Engineer and the Inspector.
4. Details of Arrangement for the Use of Convict Labor.

Subject B—Construction

1. The Proper Determination of the Amount of Realignment and of Grading to be Done.
2. The Factors Governing a Proper Selection of a Road or Street Pavement or Surfacing.
3. Materials and Methods Suitable for Road Surfaces.
4. Unit Price vs. Lump Sum Contracts.
5. Plant Equipment.
6. Preliminary Traffic Census.
7. Efficiency and Economy of Using One Size Crusher Run Stone Bituminous Concrete Pavements as a Substitute for Bituminous Pavements Constructed by Penetration Methods.
8. Dirt Roads.

Subject C—Maintenance

1. Sub-Organization for Securing Efficient Maintenance.
2. General Methods of Repairs and Renewals.
3. Methods of Dust Prevention.
4. Maintenance of Different Road Surfaces.

The general plan of providing for discussion of subjects, rather than long papers, which has been so successful in the past will be adopted at this meeting. The speakers are being selected with reference to their fitness to discuss the various questions, and announcement of these assignments will shortly be made. The list of speakers will include men who are recognized as the leading authorities in the United States and Canada.

In connection with the Congress and Convention, there will be held an exhibition of road machinery, materials and appliances. This exhibition will be known as the Fifth Annual Good Roads Exhibition and will include everything that enters into the construction, repair and maintenance of roads and pavements. This exhibition will also be held in the First Regiment Armory.

LETTERS

New York, Sept. 16, 1913.

Editor Contract Record:

I have read with much interest the article by Mr. Russell Spaulding on "Ozone Applied to Water Purification," appearing in your issue of August 13th of this year.

This article seems to bring together all recent data upon the various sterilizing plants in Europe. I quite agree with the author that there has been a marked advance in the sterilization of water supplies, and especially in so far as the application of ozone to the water is concerned. However, I should be very glad if the author or any of your readers would give better evidence as to the accuracy of the following statement found in the author's "Conclusion":

> "Aside from its wonderful and unfailing bactericidal power, ozone totally removes from water all trace of odor, color and taste due to the decomposition of organic matter."

This claim is so broad and far-reaching, that if ozone will do what the author claims for it is in this regard, its place in water purification, even as a substitute for filtration in many cases is at once assured.

I sincerely trust that the author can furnish us with evidence as to the relative accuracy of this statement.

Yours very truly,

Alexander Potter.

The report on the Ottawa water supply will be ready at an early date. The British engineers, Messrs. Binnie and Tickell, are making such progress in their work that there is a good possibility of the report being ready early in October. The mayor has stated that the reports which will be presented to the city council will be most comprehensive, taking in Lake Deschenes and other proposals which have been made from time to time. There will also be a report as to what the government is prepared to do though it is understood that as yet the cabinet has not discussed figures. When special legislation was secured for raising five million dollars for the work the stipulation was that a two-thirds vote of the city council or endorsation by the people would be necessary. It is generally understood that the five million will not be sufficient but it is also believed that there would be no difficulty in getting special legislation to expend a couple of millions more on the same condition. If the estimated cost is not too far over the five million mark there seems quite a probability of the council by a two-thirds vote settling the matter for good.

Architects' Record Meeting at Calgary

Important Transactions of The Royal Architectural Institute of Canada at Their Sixth Annual Convention Last Month

Special to the Contract Record

THE Sixth Annual Convention of the Royal Architectural Institute of Canada was held in Calgary, September 15th-16th. The first session of the Convention was held in the Lecture Room of the Calgary Public Library. Forty delegates and visitors were present from every province. The meetings were presided over by Mr. J. H. G. Russell of Winnipeg, president of the organization. The freedom of the city and a hearty welcome were extended to the visitors by Alderman W. J. Tregillus, the Acting-Mayor, in a few well chosen words. Mr. Roland W. Lines, of Edmonton, as President of the Alberta Association, in a brief speech, made the visitors welcome and at the same time gave a short resume of the business that the Convention had before it for consideration. Mr. R. A. Brocklebank, President of the Calgary Builders' Exchange, extended a cordial invitation to the Institute to be the guests of the Builders' Exchange at a "smoker" the following night. To all these expressions the president responded on behalf of the Convention, and the meeting then proceeded to business.

The reports of the Secretary, Mr. Alcide Chausse, of Montreal, and of the Treasurer, Mr. John W. H. Watts, of Ottawa, were gratifying in the extreme, and showed the Institute to be in an excellent financial condition, with a total membership of 558, of whom 491 are active members by virtue of being members of provincial associations associated with the institute.

The principal business before the Convention was the consideration of certain amendments to the by-laws, together with a proposed code of ethics, a schedule of minimum fees and regulations governing competitions. A lecture on "Cement and Concrete," by Prof. Brydone-Jack, of the Engineering School of the University of Manitoba, occupied the main portion of the first afternoon.

The most radical change in the by-laws of the Institute as adopted was that changing the method of paying dues to require each provincial association to pay into the treasurer the sum of $2 for each accredited member. Another change was that which requires the election of other than active members to be unanimous by letter ballot of the council. In the matter of the code of ethics and the rules governing competitions, the president was directed to name a committee to deal with the proposed code and rules presented to the convention before final action should be taken. By unanimous vote the convention rejected the schedule of fees proposed, at the same time voting to revert to the schedule formerly in effect.

The election of officers and members of council for the coming year resulted in the re-election of Mr. Russell as President, and of Messrs. Chausse and Watts as Secretary, and Treasurer, respectively, and of Messrs. Roland W. Lines, of Edmonton, and M. Ouillette, of Quebec, as vice-presidents. The members of council from Alberta are Mr. G. M. Lang, of Calgary; Mr. Jas. Henderson, and Mr. Roland W. Lines, of Edmonton. The next place of meeting will be the city of Quebec in 1914.

Everyone seems to have been agreed that the convention was the most successful, both in attendance and in the way of entertainment, that has yet been held, and that the West has pointed the way for future gatherings of the Institute. From the very first, both the architects and their wives were treated with the best of hospitality, and in spite of the differences of professional opinion inevitable at such meetings, the best of good fellowship prevailed. The ladies of the Calgary Chapter of the Alberta Association provided entertainment for the visiting ladies, while the delegates and visitors were royally entertained by the local architects, under the watchful eye of Mr. G. M. Lang, past vice-president.

On the evening of the 15th, the Sixth Annual Banquet of the Institute was held in the Alexandra Hotel, with the President, Mr. Russell, as toastmaster. There were many enjoyable toasts proposed and answered. Those responding, among others, were Prof. Brydone-Jack, of the University of Manitoba, Mr. H. A. Sylvester, Superintendent of Buildings for the City of Calgary, Dr. Tory, President the University of Alberta, and others. But the best of all was the informal eloquence of Sir Gilbert Parker, the Canadian author, member of the British Parliament, himself no mean architect, though not of buildings. Though present inform-

Members of the R. A. I. C. and their ladies at the Calgary Convention.

ally, Sir Gilbert held his audience well in hand with words more serious than the occasion might have demanded, taking as his theme "The Arts."

Tuesday, September 16, the members of the Convention were guests of the Alberta Association at a luncheon served at the estate of John Hextall, on the outskirts of the city, in Bowness Park, one of Calgary's beauty spots. About sixty were present at the luncheon, following a tour about the city. In the evening, when the cares of the business sessions were over, the members of the local Builders' Exchange were the hosts at a most enjoyable "smoker," at which over eighty were present. It was a characteristic of the Convention—and it is probably unique in the annals of any such professional bodies—that the architects and contractors could get together so informally at the closing function without being accused of conspiracy.

Mr. J. H. G. Russell, of Winnipeg, who has been re-elected president of the Royal Architectural Institute of Canada.

W.W.H.

The Dominion Government are negotiating for the construction of a drydock at Vancouver with an initial capacity of 16,000 tons, which can be considerably enlarged if necessary.

Should a grain blockade occur this winter, as in some seasons past, the National Transcontinental Line from Winnipeg to Cochrane will be placed in commission as a means of relief. Although this section of the Transcontinental will not be entirely complete until next spring, it can be utilized for service to relieve a strain if necessary this fall. A train of six heavy private cars was moved over the line at high speed recently.

Excavation is under way at Prince Rupert for an hotel for the Grand Trunk Pacific Railway Company. The new hotel will, when completed, be the largest of the system. The site is bounded by First and Second avenues and Third and Sixth streets, and the building is 310 feet long with an average depth of 150 feet. Standing a short distance back from the water's edge the hotel commands a magnificent view of the harbor. It will be complete and up-to-date in every respect and will rank with the finest hotels of the Dominion when finished. The plans were drawn by F. M. Rattenbury, of Victoria. The general design of the building is of the Chateau type, similar to that of the Fort Garry in Winnipeg and other hotels now in course of erection.

Mainly Constructional

The News in Brief—From Coast to Coast

Messrs. Nicholson & Bain will erect a six-storey warehouse with basement at Edmonton at a cost of $70,000.

The first "flatiron" building in Edmonton, which is now in course of construction, will be finished before the end of the year.

The first annual meeting of the Sanitary Inspectors' Association of Western Canada was held at Regina on September 19th.

The Mount Royal Brick Company, of Montreal, will begin operations during October. There has been some delay in the completion of the plant.

A three-storey brick and concrete customs house building is to be built at Fort William. The structure will be one hundred feet long and eighty-five feet wide.

The new water system for the City of Hamilton, Ont., will be ready for operation in a few weeks and no difficulty is expected in supplying satisfactory service.

The Pedlar People, Limited, have established a branch factory at Montreal and removed their eastern office to 26 Nazareth Street, Montreal. Mr. W. E. Ramsay is manager.

It is the intention of the Dominion Dredging Company to continue the work on the Welland canal throughout the winter, and it is hoped that the work will be completed in five years.

Representatives of the Board of Trade of Toronto recently made an extensive tour of that city in company with the commissioner of works to inspect the various large municipal undertakings now being carried on.

The Dominion Bridge Company recently placed a two million pound steel bridge in position on the stone upright of the Lachine bridge in the remarkable time of one hour and twenty-five minutes.

The addition to the No. 1 elevator of the National Harbour Commissioners will be completed before close of navigation, which is earlier than was anticipated, J. S. Metcalf & Company, Montreal, are the builders.

The Canadian Westinghouse Company have decided to build an additional factory at Hamilton, Ont., at a cost of about $150,000. The building will be of reinforced concrete and work will be started on it at an early date.

The Canadian Northern and the Great Northern railways are negotiating as to the building of a joint union depot at False Creek, B.C. It is also possible that the Grand Trunk Pacific Railway may join in this scheme.

The city council of Winnipeg have decided to make a number of improvements towards beautifying their city, one of the most important being the laying out of a straight new thoroughfare from Portage avenue to Broadway.

The budget of the City of Westmount, P.Q., shows appropriations of $395,264, of which $96,574 will be spent on roads, $25,000 on street lighting, and $142,977 will be appropriated to the finance and municipal buildings committee.

At a recent conference between Mr. F. H. Gutelius, general manager of the Intercolonial Railway, and the Minister of Railways and Canals, it was decided to let the tenders for double tracking this railway at Levis, Que., at an early date.

Plans have been completed for a combined fire-hall and police station, costing $350,000, to be erected at Elizabeth street and Fraser avenue by the municipality of Edmonton. It is announced that provisions will be made in the estimates for 1910 so that work on the structure may proceed early next season.

Montreal's new $3,000,000 filtration plant is not large enough. Within twelve months at the latest another $1,000,000 or more will have to be spent on the work in order that it may meet the requirements of the city.

The five-storey and basement warehouse and office building of the Cockshutt Plow Company, Limited, at Calgary, has just been completed. It has a frontage of one hundred feet and a depth of one hundred and twenty feet and cost over $150,000.

Building permits at Fort William for the first eight months of 1913 amounted to $3,310,760, as compared with $2,781,950 for the corresponding period of 1912. Many large plants are at present in course of construction, the most noticeable being the incinerator plant, the car works and the nail works.

It is stated that by the end of this year there will only be a break of fifty miles in the whole transcontinental line of the Canadian Northern Railway Company from the Pacific coast to Quebec. At this point the line connects with the Atlantic coast, via Intercolonial Railway. The 50-mile stretch is in British Columbia.

A Commission has now been appointed to draw up a scheme for the beautification of Hull and Ottawa. The Commission will consist of the following: Mr. Herbert S. Holt, Montreal; Mr. Frank Darling and Mr. R. Home Smith, Toronto; Sir Alexander Lacoste, K.C., Montreal, and the mayors of Ottawa and Hull ex-officio.

That the general hospital board of Medicine Hat proceed with the preparation of plans and the construction of a new hospital building to cost in the neighborhood of $250,000 was the recommendation contained in the report of the special committee appointed to go thoroughly into the question of building a new hospital, received at a meeting of the hospital board recently.

Excavation work on the site of the new Hudson's Bay department store in the city of Victoria will commence in a day or two by Messrs. Luney Brothers of Winnipeg, who have been awarded the contract for this preliminary undertaking, and it is expected that the announcement of the letting of the contract for the construction of the building itself will be made while the excavation is in progress.

Sir William Mackenzie, accompanied by Lady Mackenzie and Mr. M. H. MacLeod, general manager of the western lines of the Canadian Northern Railway, arrived in Winnipeg recently on his return from a tour of inspection over the western lines of the system. Sir William has been over the new portion of the main line, and has had an opportunity of visiting several of the important points on the system.

Mr. J. D. McArthur, railway contractor, of Winnipeg, has written to the Government offering to take over the Albert and Great Waterways railway on terms satisfactory to the representatives of the bondholders and the Royal Bank and to construct a line between Edmonton and Fort McMurray via a route approved by the Government, the specifications, however, to be similar to those of the Edmonton-Dunvegan and B. C. Railway.

Officials of the Great Northern and C. N. R. railways were in conference recently at Vancouver discussing the question of a union depot. No definite decision has been issued as yet. According to the city's agreement with the C. N. R. that railway was bound to build a station to cost $1,000,000. The present station of the C. N. R. on the north side of the creek is entirely inadequate for the needs of a transcontinental railway.

The Dunnville, Wellandport & Beamsville Electric Railway is reported to have completed arrangements for a sale of additional bonds, and will resume construction work on its projected 23-mile line. About 13 miles have been graded, and the bridges and structural work completed on the section. The line has a charter from Port Dover to St. Catharines, with branches to Dunnville, Welland, Jordan Harbor and other points. J. A. Ross, Wellandport, Ont., is president.

The annual convention of the American Road Congress is now in session at Detroit. The congress is being held under the auspices of the American Highways Association, and is presided over by Mr. L. W. Page, director of the United States Office of Public Highways and president of the American Highways Association. Mr. W. A. McLean, vice-chairman of the Provincial Highways Commission, will lead the discussion on bitulithic construction and maintenance.

It is said that the government is considering a large building programme for Ottawa. It is proposed to tear down the present unsightly printing bureau building and replace it by a large modern building on another site. On the present building bureau site it is the intention to build a national library, the parliamentary library being too small to meet the present requirements. It is also proposed to enlarge the archives building, which has become crowded, to twice its present size.

At the meeting of the Committee on Works on October 3, Assessment Commissioner Forman and Works Commissioner Harris, of Toronto, will present a report on the widening of Yonge street by 20 feet, from north of Bloor to the north city limits. The Assessment Department is at present engaged in making valuations of the buildings and land damages. The work is to be carried out under the Local Improvement Act and the necessary land taken from the west side of the street. The subway is to be 86 feet wide.

Over $20,000 has been spent by the Provincial Board of Health in conducing the sanitary survey of lake waters during the past summer. The work, which is now nearing completion, involved investigating boundary waters at a score of points between Kingston on the east and Fort Frances on the west. Between 17,000 and 18,000 tests have been made, and while the results have not been tabulated, it is understood that positive evidence of the board's contention that there was pollution from sewage deposited into the great lakes from large cities along the border has been established. The work has taken six months.

A report by the provincial government surveyors who have inspected Seymour Creek, a stream flowing south into Burrard Inlet, for the Vancouver civic authorities, has just been published. It is stated that a lake at the Seymour Creek Falls with an area of 8 to 10 square miles could be formed by a dam at this point. Provision for a hydro-electric power plant could be made by piping water down three miles, where a head of 200 feet could be obtained and the water still be available for the supply of Vancouver after passing through the turbines.

With a view to erecting a provincial government telephone line from Heriot Bay across Valdez Island to the mainland. Mr. H. E. Elsden, is at present engaged in a survey of the route and preparing an estimate of the cost of construction. The proposed new line will be sixty miles in length and will connect with the Dominion Government line at Heriot Bay and terminate at Loughbury Inlet on the mainland, Mr. H. E. Elsden is at present engaged in a survey of purpose of the proposed new line is to afford communication to the fire guards and timber officials who are engaged in preserving the forest wealth of the district through which the line will pass.

Personal Mention

Mr. W. S. Harvey has been appointed Acting City Engineer of Lethbridge, Alta., vice Mr. A. C. D. Blanchard resigned, until such time as a permanent appointment shall be made.

Sir Philip Watts and Mr. J. H. Noble, directors of the Armstrong-Whitworth Company, Newcastle, England, in company with Mr. M. J. Butler, the consulting engineer, recently visited the steel works of the company now being constructed at Longueuil, P.Q. The contract for the buildings is being carried out by Mr. E. G. M. Cape, some two hundred men being engaged in erecting five buildings. The visitors are now in the west on their way to Japan.

Messrs. Arthur H. Blanchard, M. Can. Soc. C. E., Consulting Highway Engineer and Professor in charge of the Graduate Course in Highway Engineering at Columbia University, and Provost Hubbard, Assoc. Am. Soc. C. E., Consulting Chemist, in Charge of the Division of Roads and Pavements, The Institute of Industrial Research of Washington and Lecturer in Highway Engineering Chemistry in Columbia University, have formed a partnership under the firm name of Blanchard and Hubbard, Highway Efficiency Experts, with offices at Broadway and 117th Street, New York City. At present Messrs. Blanchard and Hubbard are retained by Commissioner John H. Delaney as the Advisory Board on Highways for the New York State Department of Efficiency and Economy.

The Late Mr. James Ross, C.E., of Montreal

The death of Mr. James Ross, C.E., in Montreal, on September 20th, from heart disease, involves the loss to Canada of one of its foremost engineers and contractors, and one who has been identified with the development of many important enterprises. He was chiefly known as a contractor for national railways and the promoter and manager of electric lines. A Scotchman by birth, he received his training in England and Scotland, and then went to the United States, where he acted as engineer and manager to some railway companies. Later, Mr. Ross was connected with Canadian lines, and in 1883 took control of the construction of the Canadian Pacific Railway west of Winnipeg, and in 1885 completed for the company their line over the Rocky Mountains, the Selkirk and the Gold Range. In 1886 he undertook for the C. P. R. the settlement of their location east of Montreal, and their legislation in Maine, and upon the completion of this work took the contract for the construction of the remaining portion of their line not already provided for.

In later years Mr. Ross devoted his chief attention to the reorganization of street railways. In 1892 he joined Mr. William Mackenzie in purchasing the Toronto railway from the city of Toronto, and afterwards rebuilt its tracks, making it an electric line. In 1892 he undertook the reorganization of the Montreal Street Railway, changing it from a horse line to an electric service. He also converted in a like manner the street railways of Winnipeg and St. John. In 1896 he and Mr. Mackenzie acquired the tramways systems in Birmingham, Eng., and formed the City of Birmingham Tramways Company, Limited, for the operation of the road under an electric system, and in 1897, with Mr. Mackenzie and others, he secured a charter and franchise from the Government of Jamaica to build electric tramways on the Island.

He was at various periods president and managing director of the Montreal street railway; vice-president of the Toronto street railway; president of the Winnipeg and St. John street railways and president of the Dominion Bridge Company. Mr. Ross took a prominent part in the affairs of the Dominion Coal Company and the Dominion Iron and Steel Company, and fought strenuously for the former concern when the two companies became involved in litigation. After judgment had been given, his interests in the Coal Company were purchased for $4,750,000, and he retired from the presidency, the two concerns being amalgamated.

At his death Mr. Ross was director of the Bank of Montreal; Calgary and Edmonton Land Company, Limited; Canada Life Insurance Company; Canada Sugar Refining Company, Limited; Canadian General Electric Company, Limited; Dominion Bridge Company; Laurentide Paper Company, Limited; Royal Trust Company, and St. John Railway Company.

Successful New Enterprises

A concern, news of whose entrance into the constructional field will be of interest to our readers, is the Eberhard & Wood Manufacturing Company, makers of ornamental and general iron work.

The principals, Mr. C. R. Eberhard, C.E., and Mr. T. H. Wood, have had extended experience in this class of work and are also the Toronto representatives of the Dennis Wire & Iron Works Company, Limited, London, Ont. The company actually commenced operations about two years ago, directing their attention to local orders, which have assumed such importance that the number of employees engaged has increased from three to fifty.

Among the recent contracts executed in conjunction with the Dennis Wire & Iron Works, mention may be made of the west wing of the Parliament Buildings, six buildings of the new General Hospital, Sick Children's Hospital, T. Eaton Memorial Church, Upper Canada Bible Society's Building (iron stairs), Foresters' Building (iron stairs), Customs House (iron stairs), General Post Office (iron work), several of the Bell Telephone Company's buildings (fire escapes) and the R. S. Williams Building (fire escape), all in Toronto.

Trade Notes

Owen clam shell buckets and material handling machinery are featured in a catalogue received from the Owen Bucket Company, Cleveland, Ohio. The lines manufactured by this company are constructed to withstand great strain and hard usage. The principles of operation are claimed to be unexcelled. The manufacturers claim that their clam shell bucket will ensure a bigger day's work than any other. A separate booklet is devoted largely to illustrating the possibilities of Owen buckets in operation.

"The Court Record of Five Witnesses" is a most original catalogue which is being distributed by the Ceresit Waterproofing Company, Chicago. In this catalogue, which is issued in five parts, the company's waterproofing is put on trial and five "witnesses"—Professor Scientist, Mr. Engineer, Mr. Builder, Mr. Owner and Mr. Demonstrator offer convincing testimony which results in a verdict in favor of the company. The individual story of each witness is told separately. Readers desirous of obtaining copies are requested to fill in the coupon contained in the firm's advertisement in this issue.

Parian ware, which is claimed to give "sunlight without glare" is described in Catalogue No. 35, issued by Gill Bros. Company, manufacturers of illuminating glassware, Steubenville, Ohio. Semi-indirect lighting, which is claimed to be the most advantageous kind, is held to find its highest expression of efficiency in Parian ware. The most beautiful globes and shades are illustrated in excellent half-tones in this catalogue and the effect produced by means of the ware would appear to be the same as though the light were filtered through a translucent piece of exquisite marble. Copies of the catalogue are well worth sending for.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Estevan, Sask.
Storm and sanitary sewer planned by Town Council. Sec.-Treas., P. J. Stephens. By-law submitted to ratepayers on Sept. 23rd.

London, Ont.
Sewers, cost $450,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting Engineers, Chipman & Power, Mail Bldg., Toronto. Trunk sewer from Dundas street to River $400,000. Extension of sewer in Ealing District $50,000. Vote to be taken Oct. 16th.

Municipal paving plant contemplated by the City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant.

Montreal, Que.
Tenders received by Sec., L. N. Senecal, Board of Commrs., till noon, Oct. 3rd, for sewers on MacGregor St., Lacordaire St., Montsabre St., Turenne St., George V. Ave., King Edward VII. Ave., St. Catherine St., Lafontaine St., Adam St., Ontario St., Monkland St. Specifications, etc., at office of Engineer Superintendent of Sewers.

Oakville, Ont.
Council will have cement walks laid on Colborne, Bond and Kerr Sts., and sewer on Colborne street.

Ottawa, Ont.
Asphalt pavements, Clarence and O'Connor, planned by City Council. Mayor, J. A. Ellis. Time extended for receiving tenders until 4 p.m. Oct. 2nd. Specifications, etc., at office of Engineer, Archibald Currie.

Regina, Sask.
City Council contemplate addition to Sewage Disposal Works of another filter bed. Engineer, F. McArthur.

Stamford, Ont.
1,000 ft. concrete roadway, 16 ft. wide contemplated. Clerk, C. F. Munroe, Southend. Matter has been passed by Council.

Stratford, Ont.
Waterworks supplies. Separate tenders received by Sec.-Treas., W. H. Trethway, until Oct. 4th, for:—"A" 150 h.p. steel boiler to carry 120 lb. working pressure. Specifications, etc., to accompany offer, "B" Similar boiler, 150 lbs. working pressure. "C" 1 high duty reciprocating steam pump to deliver 1¼ million imperial gallons of water per 24 hours at 80 lbs. pressure. Preference given to pump doing this duty economically but capable of getting 120 lbs. water pressure when required for fighting fires. Specifications to accompany offers. To be delivered 6 weeks from acceptance of bid.

Toronto, Ont.
Sewers. Tenders received by Mayor H. C. Hocken, Chairman, Board of Control, until Oct. 7th. Plans at Dept. of Works, City Hall. Lightbourne, Chandos, Belsize, Morrison Ave., Wells Hill, Beach Ave., Esplanade and Woodville Ave. East Toronto Outlet. Esplanade Sewer Sanitary, Contract No. 87, Sec. 1. Earlscourt Drainage System No. 2. Danforth Ave. S. O. S. Sec. No. 1.

Pavements planned by Board of Control, Mayor H. C. Hocken. Tenders received until Oct. 7th. Plans at office of Dept. of Works. Asphalt on Beaumont, Bellair, Browning, Carlaw, Cumberland. Dunn, Elliott, Grange and Wolseley. Brick block on Symington. Bitulithic on Mavety. Concrete on lane north of First Ave.

Tenders received by Mayor, H. C. Hocken, until Oct. 21st for 20 and 36-in. cast iron pipe; 20 and 36-in. cast iron special castings; 20 and 36-in. stop valves. Specifications at Room 9, Dept. of Works, City Hall.

Works Commissioner Harris recommends grading the following streets: Glencairn Rd., Spring, Glenwood and Windermere Aves., cost $16,138. Glenholme Drive, $30,523, and pavements: Sunnyside, Gladstone, Herbert, Grenville, Hibernia, Logan, Homewood Place, Woodycrest, Quebec and Pendrith. Cost $56,432. Board of Control. Mayor, H. C. Hocken.

Five ft. cement concrete sidewalks on a number of streets. Estimated cost $70,000. Mayor, H. C. Hocken.

Brick block pavements on Wellington W. from Spadina to Portland. 42 ft. wide, estimated cost $28,328.

46 ft. pavement, Terauley St., treated wood block on 6 in. concrete foundation. Cost $31,000. Brick block pavement recommended for St. Clair from McRoberts Ave. to G. T. R. Cost $14,000. Board of Control. Mayor, H. C. Hocken.

Widening and grading planned by Board of Control. Mayor, H. C. Hocken. Poplar Plains Road widening from Macpherson Ave. to Clarendon Crescent, 50 ft. wide. Estimated cost $64,775. Dufferin St. from Temple to Springhurst, 91 ft. wide. Estimated cost $9,950.

Victoria, B.C.
By-law will be voted on October 2nd for acquiring and constructing the Sooke Lake Water Supply System. City Clerk, Wellington J. Dowler.

CONTRACTS AWARDED

Brantford, Ont.
Cement sidewalks, Aberdeen St. and Hamilton Road, planned by Twp. Council. Clerk, J. A. Smith, County Bldgs., Brantford. Engineer, A. M. Jackson, Temple Bldg., Brantford. General contractors, Royal Artificial Stone Paving Co., (Conely Bros., Guelph). 4,053 ft. of 4 ft. cement sidewalks, at 11½c. per sq. ft. 7,810 lin. feet, at 12½c. per sq. ft.

Dundas, Ont.
Cement walks, curbs, retaining wall and grading on King, McMurray and Foundry Sts., planned. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Govt. Insp. of Bldgs., Jas. Smith. General contractor, J. W. Dickson, Dundas.

Fort William, Ont.
Water mains, cost $53,000, Island No. 2. City is laying 14 in. and 16 in. water mains on Island, also across Mission River. Work done by day labor under City Engineer, Ray R. Knight.

North Battleford, Sask.
Sewage system planned by City Council. Engineer, A. Stirling. General contractor, Wm. Newman & Co., Ltd., 409 Ashdown, Winnipeg.

Oakville, Ont.
Paving, Dundas St., planned by Town Council. Chairman Streets Com., C. H. Cross. General contractors, Service Constr. Co., Guelph. Concrete pavement at 18 3-5c. per sq. yd., curbings at 38½c., catch basins at $12.50.

St. Eustache, Que.
Macadamizing roads planned by Municipal Council. Sec.-Treas., J. A. G. Belisle. General contractor, Alfred Villeneuve, Petite Riviere. St. Eustache and Adelard Charrette.

Winnipeg, Man.
Sewer, cost $4,543.31, on Ferry Lane, for Rural Municipality of Kildonan. Clerk, H. Thompson, 215 Chambers of Commerce, Winnipeg. General contractors, Thos. Jackson & Sons, Colony St.

Sewer (St. Mary's and St. Annes Rds.) for Rural Municipality of St. Vital. Sec.-treas., G. J. Charette, Grandvital P. O. General contractor, Thos. Jackson & Sons, Colony St., $162,000. 1¼ miles of trunk sewers.

Railroads, Bridges and Wharves

Bracebridge, Ont.
Extension to wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 21st. Plans, etc., at offices of J. H. Armstrong, Dist. Engineer, Midland, J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, Postmaster, Bracebridge and at Dept., Ottawa.

Brantford, Ont.
City Engineer, T. Harry Jones, has been instructed to prepare plans for construction of dyke across property near foot of West Mill St., to be about ½ mile long.

Cap Chat, Que.
Extension to pier. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom.

Govt., Dept. of Public Works, till Oct. 22nd. Plans, etc., at offices of J. T. Bertrand, Dist. Engineer, Isle Verte, Que., Chas. Chapais, Dist. Engineer, Post Office Bldg., Que., Postmaster, Cap Chat, and at Dept., Ottawa.

Camrose, Alta.
C. P. Rly. have been authorized to construct 3 spurs, for Vernon Fruit Co., Provincial Telephone Co. and a branch line.

Calgary, Alta.
C. P. Rly. have been authorized to construct a spur into premises of Olgivie Flour Mills Co., Ltd.

Cariboo District, B.C.
G. T. P. Rly. Co. has approved of location of station at mileage 1179.2.

Dorenlee, Alta.
G. T. P. Branch Lines Co.'s site and station have been approved on the Tofield-Calgary Branch.

Haileybury, Ont.
The Temiskaming & Northern Ont. Rly. Commsn. propose to electrify Kerr Lake Branch, between Cobalt and Haileybury. Chairman, J. L. Englehart, Toronto street, Toronto.

Halifax, N.S.
Bridge planned for Dominion Atlantic Rly. Has been authorized to be constructed over Cambridge Brook 77.9 miles from Halifax.

Hamilton, Ont.
Freight shed, Main and St. Catharine Sts., planned for Dom. Power & Transmission Co. Supt., Geo. E. Waller. Work on new freight shed to be started shortly to replace one destroyed by fire.

London, Ont.
Breakwater, cost $25,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Date for submitting by-law to ratepayers has been changed to October 22nd.

Breakwater, cost $25,000, contemplated by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Ratepayers will vote on by-law Oct. 15th. Reinforced concrete, 1,800 ft. long.

Province of Manitoba
Branch line of C. N. Rly. Grosse Isle Branch location, through Twp. 25 has been approved.

Milton, Ont.
By-law passed to raise $40,000 to complete High Level Bridge over 16 mile creek near Oakville and paper mill bridge and dam near Georgetown.

Montreal, Que.
Freight sheds, cost $200,000, for Harbour Commrs. of Montreal. Engineer, F. W. Cowie, 57 Common St. Piling, Raymond Concrete Piling Co., New Birks Bldg. Tenders called in a week by Commrs. for steel. Two storeys, 112 x 485.

G. T. Rly. have been authorized to construct a siding into premises of the Dominion Textile Co., Ltd., and a spur into premises of the Grasselli Chemical Co., Ltd.

Moose Jaw, Sask.
C. P. Rly. have been authorized to construct a spur for Whitlock & Riddell.

North River Bridge, P.E.I.
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, till Oct. 7th. Specifications, etc., at office of W. E. Hyndman, Dist. Engineer, Charlottetown. 260 ft. long, 30 ft. and 20 ft. wide, approach 180 ft. long, outer block, 80 ft. long x 30 ft. wide.

Red Deer, Alta.
C. P. Rly. has been authorized to construct bridge No. 93, Red Deer, Edmonton Sub.-Div.

Sault Ste. Marie, Ont.
Canal contemplated. Dom. Govt., Dept. of Railways & Canals, is expropriating land. Minister, Hon. Robt. Rogers, Ottawa.

St. Anne Des Monts, Que.
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, till Oct. 22nd. Plans, etc., at offices of Chas. Chapais, Dist. Engineer, Post Office, Que., J. L. Michaud, Dist. Engineer, Post Office Bldg., Montreal, Postmaster, St. Anne des Monts, and at Dept., Ottawa.

St. Catharines, Ont.
Welland Canal, Section No. 2. Tenders received by Sec., L. K. Jones, Ottawa, Dom. Govt. Dept. of Railways and Canals, till noon Oct. 15th. Plans, etc., at office of Chief Engineer of Dept., Ottawa, and Engineer-in-charge, St. Catharines.

Province of Saskatchewan
C. N. Rly. have authorized the construction of bridges at mileage 78.4, Moose Jaw, at mileage 3.2, Moose Jaw, Sub.-Div., at mileage 87.0, Rush Lake, Swift Current, at mileage 92.1, over Antelope Creek, Swift Current Section Western Div. at Swift Current Sub.-Div. have been authorized.

Smithers, B.C.
G. T. P. Rly. Co.'s location for station at Smithers, mileage 226.5, Prince Rupert East, has been approved.

Sturgis, Sask.
Stock yards planned by C. N. Rly. One pen, 2-car capacity, stock yard with platform and chute.

Toronto, Ont.
Canadian Pacific Railway Company has been authorized to construct a switching lead across lots 9 to 27 inclusive northerly of Vine St.

Concrete curbings planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Oct. 7th. Plans, etc. at Dept. of Works. Avondale, Beaumont, Bellair, Dufferin, Elm Ave., Nanton, Symington, Wolseley. Grading Rosemont from Alberta to Oakwood.

Street car barn, cost $14,000, Bracondale, near Benson, planned. Mayor, H. C. Hocken. Work will probably be done by day labor. One storey, steel and brick construction, brick and concrete foundation.

Vancouver, B.C.
Car barns, cost $300,000, 13th Ave., for The British Columbia Electric Rly. Co., 425 Carrall. Two storeys, reinforced concrete construction. Plans prepared.

Wood Islands, P.E.I.
Extension of breakwater. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, till Oct. 7th. Plans, etc at office of W. E. Hyndman, Dist. Engineer, Charlottetown. Extension 100 ft. long x 40 ft. wide, close-faced timber cribwork, interior filled with granite limestone or other imported hardstone.

Weyburn, Sask.
C. P. Rly. Co.'s location of stations at Melavel, Readlyn, Woodraw and Lafleeche on the Weyburn westerly branch has been approved.

Winnipeg, Man.
Board of Control contemplate the construction of a concrete bridge over Assiniboine River at Arlington Street. Secretary, M. Peterson.

CONTRACTS AWARDED

Annapolis Royal, N.S.
Piers, cost $34,700, planned for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Reid & Archibald.

Twp. Bentinck, Ont.
Bridge, cost $3,500, planned by Twp. Council. Clerk, J. H. Chittick, Lamlash, Ont. Cement work, Joseph Cope, Chesley, Ont. Steel work, Corbett Co., Owen Sound.

Kingston, Ont.
Underground conduit, King and Princess Sts. Gen. Mgr. Civic Utilities, C. C. Folger. General contractors, Dietrich Co., Montreal, Que. Contract for supplying and laying 5,000 ft. of duct, $11,887.

London, Ont.
Steam railway line to Port Talbot planned. General contractors, Canadian Stewart Co., C. P. R. Bldg., Toronto. Surveyor in charge, Engineer S. Wilson.

Ottawa, Ont.
Booster building, cost $6,000, Nelson St., for Ottawa Elec. Rly. Supt., Fred. Burpee. Architect, J. Albert Ewart, 193 Sparks St. General contractor, Geo. Crain, Clemow Ave.

St. Malo, Que.
Car shop repair plant, cost $1,500,000, planned by Commrs. Transcontinental Rly. Sec., P. E. Ryan, Ottawa. General contractor, Jos. Gosselin, Levis, Que. Cast iron pipes, etc., L. H. Gaudry, 76 St. Pierre St., Que. Sub-contractor for some of supplies, Canada Iron Corporation, Ltd., Mark Fisher Bldg., Montreal.

Toronto, Ont.
Car shed addition, cost $9,000, Connaught Ave., for Toronto Street Rly., King and Church. Architect, H. G. Salisbury, 10 Adelaide E. General contractor, Owner. Supt. in charge, G. Fleming. Two storeys, 30 x 60, brick and steel construction, brick foundation, felt and gravel roofing.

Waterford, Ont.
Bridge, Pond Road. Clerk, James Ross. General contractors, The Maple Leaf Paving Co., Simcoe.

Public Buildings, Churches, Schools, etc.

Barrie, Ont.
Armoury, Queen's Park, planned by Dom. Govt. Dept. of Militia and Defence.

Sec., E. F. Jarvis, Ottawa. Site chosen, has been approved and tenders will be called shortly.

Battleford, Sask.
Collegiate planned by City Council. Sec.-treas., H. Basil Thompson. By-law for the expenditure of $55,000, to finish and furnish school was passed.

Berlin, Ont.
Church, cost $40,000, Benton and Church Sts., planned for St. Matthews Lutheran Church. Tenders received by Chairman Building Committee, A. Sippel.

Brantford, Ont.
Tenders received by Sec., H. F. McNaughton, Parliament Bldgs., Toronto, Prov. Govt. Dept. of Public Works, until Oct. 6th for heating, plumbing and electric wiring in Institute for the Bland. Plans, etc., at Institution and at Dept., Toronto.

Canora, Sask.
Plumbing and heating for school. Tenders received by Sec.-Treas., till Oct. 4th. Plans and specifications at office of Sec.-Treas., H. M. Sutherland. Architect, F. R. Evans, Somerset Block, Winnipeg.

Fisher River, Man.
Residence. Dom. Govt. Dept. of Indian Affairs. Sec., J. D. McLean, Ottawa. Residence will be in Agency Ground in Peguis Indian Reserve at Fisher River. Plans, specifications, at offices of Indian Affairs at Winnipeg, Selkirk and Portage la Prairie, also at Post Offices at Teulon, Arborg and Stonewall. Tenders received by Sec., till noon Oct. 15th, 1913.

Fort William, Ont.
Customs house, cost $100,000, May & Leith, planned by Dom. Govt. Dept. of Public Works. Tenders close with Sec., R. C. Desrochers, Ottawa, Oct. 14th. Three storeys, 100 x 80, reinforced concrete, stone, steel, hollow tile and brick construction, concrete and pile foundation, felt and gravel roofing, electric lighting, steam heating, oak floors, plumbing, terrazzo tiling, plate glass, galvanized iron, ventilators, cornices, architectural iron stairs, vaults, passenger elevator.

Fredericton, N.B.
Central fire station, King st., planned by City Council. Clerk, J. W. McCready. Architect, Kenneth R. Campbell. Foundation, J. Fred Ryan, $1,565. Foundation to be completed by October 1st. Tenders for other trades to be called. Three storeys, freestone and tapestry brick construction.

Guelph, Ont.
Hockey rink, cost $10,000, for Ontario Agricultural College. Plans will be prepared.

Kingston, Ont.
Rifle range planned by Dom. Govt., Dept. of Militia & Defence. Secretary, E. F. Jarvis, Ottawa. Tenders received by Director of Contracts, Ottawa, until noon, Oct 11th. Plans, etc., at offices of Officer Commanding 3rd Division Area, Kingston, and Director-General of Engineer Services, Ottawa.

L'Epiphanie, Que.
College, cost $125,000, for R. C. School Commissioners, L'Epiphanie. Tenders received by Architects, Viau & Venne, 76 St. Gabriel St., Montreal, after Oct. 31st. Three storeys, 150 x 60.

Melville, Sask.
Convent, cost $15,000, contemplated for Order of Benedictine Nuns. This work will not be commenced nor arrangements made until 1914.

La Pas, Man.
Church for Methodist Congregation. Pastor, Rev. D. Howland, B.A. Have purchased a site and plans will be prepared.

Montreal, Que.
Club house contemplated, Cherrier, for National Amateur Athletic Association, care A. L. Caron, Caron Building, Bleury street. Architect not chosen.

Golf club house, cost $3,000, for Beaconsfield Golf Club, c/o Mr. R. J. Tooke of R. J. Tooke & Co., Ltd., Montreal. Architects, Brown & Vallance, Canada Life Bldg., Montreal. Field stone foundation, roughcast construction. Tenders in.

Library and club rooms, Mountain, for Natural History Society of Montreal. Secretary, Mr. Griffin, 365 Mountain St. Plans in progress.

College, cost $400,000, for Loyola College, 68 Drummond St. Architects, Peden & McLaren, 20 St. Alexis. Excavating, A. D. Masson, Quebec. Tenders will be called as work progresses 180 ft. with wings, concrete foundation, Indiana or local stone and fireproof construction.

Oshawa, Ont.
School contemplated by the Board of Education. Chairman, Mr. Everson. Committee will have plans prepared and receive estimates.

Orangeville, Ont.
Remodelling Town Hall contemplated by Town Council. Architect, Chas. King. Plans being prepared. Tenders will be called.

Ottawa, Ont.
National library contemplated by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Propose to build library on site of present printing bureau.

Dom. Govt., Dept. of Public Works, plan enlargement of archives building to twice its present size. Secretary, R. C. Desrochers.

Point Grey, B.C.
University for Prov. Govt., Dept. of Public Works. Architects, Sharpe & Thompson, London Bldg., Vancouver. Engineer, J. E. Griffith. Plans in progress.

Prince Albert, Sask.
By-law to raise money for the construction of a public library passed. Plans will be prepared.

Regina, Sask
Police Station, cost $150,000, planned by City Council. City Commissioner, L. A. Thornton. Architects, Clemsha & Portnall, 1721 Scarth St. Work will be postponed till next spring.

Renfrew, Ont.
Curling Rink contemplated. President, H. A. Tofield. Architect, J. D. McNicoll. Committee has been appointed to look into matter of securing site, comprising Messrs. Tofield, D. H. McAndrew, J. D. Cameron, G. G. McNab & H. W. Airth. Two storeys, 34 x 17, brick construction, shingle and building paper roofing.

St. John, N.B.
Tuberculosis hospital, Merritt, contemplated by Board of Hospital Commissioners. Chairman, H. B. Schofield, City Hall. Architect, F. Neil Brodie, 42 Princess St. New sketches approved, new plans to be drawn at once.

South Vancouver, B.C.
Post Office planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Appropriation of $20,000 made by government for site, which has been secured.

Toronto, Ont.
Addition and alterations to theatre, Queen St. W., for Geo. Dodds, 604 Queen St. W. Plans will be prepared.

Gateway, cost $4,000, High Park Ave. and High Park, planned by Board of Control. Tenders received by Chairman, Mayor H. C. Hocken, until 12 o'clock noon, Oct. 7th, for erection of ornamental stone and iron gateway. Specifications, etc., at office of Parks Dept., City Hall.

Masonic Temple, Spadina, contemplated. President, J. Ross Robertson. Competitive designs will be received up to noon, January 20th, 1914. Full information from W. H. Best, 181 Avenue Road.

Theatre, cost $14,000, Roncesvalles & Galley, for Wilson Lumber Co., 1 Spadina Ave. Architect, A. H. Start, 105 Melville. Tenders received by owner now. Two storeys, 26 x 110, brick and steel construction, stone foundation.

Vancouver, B.C.
Immigration building, cost $300,000, Foot of Victoria Drive, for Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Five storeys, 220 x 64, reinforced steel beam construction, elevators. Tenders will be called in about two weeks.

Post office, cost $100,000, Mt. Pleasant, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, A. Campbell Hope, 603 Hastings St. W. Fireproof, stone, pressed brick and marble construction. Tenders wil lbe called shortly.

Victoria, B.C.
School, James Bay. Secretary, W. T. C. Pope, 1127 Catherine St. Architect, J. C. M. Keith, 416 Sayward Bldg. Four rooms. Plans in progress.

Twp. West Flamboro, Ont.
Heating system contemplated by Methodist Church Congregation. Pastor, Rev. H. L. Merner, Copetown. Plans will be prepared.

Winnipeg, Man.
Athletic headquarters, cost $15,000, Sargent Ave. Park. Tenders called for construction of foundation and walls up to second floor. Board of Control, Secretary, M. Peterson.

CONTRACTS AWARDED

Blackstock, Ont.
Drill Hall, cost $12,500, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa.

General contractor, W. A. Tom, Collingwood. Foundations in.

Brampton, Ont.
Drill Hall, cost $16,000, planned by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractor, W. A. Tom, Collingwood. Cement work not yet awarded.

Collingwood, Ont.
Nurses' home, cost $6,000, for General & Marine Hospital Board, Peel St. Chairman Hospital Trustees, H. Y. Telfer. Architect, John Wilson, Hurontario St. Builder, Mr. Thos. Long.

Dundas, Ont.
Sunday School for St. James Church Congregation. General contractor, F. A. Nelson. Contract for heating and electric lighting in Sunday School. Electric lighting for church will be considered shortly.

Fort William, Ont.
Alterations to church, cost $2,500, Pruden, for St. Andrews Pres. Church. Architect, M. H. Bradin. General contractor, Peter Sell. Brick veneer construction, concrete foundation.

Halifax, N.S.
Extension to College, cost $45,000, Windsor street, for R. C. Corporation. Archbishop of Halifax, Rev. Dr. McCarthy, Dresden Row. Architect, H. E. Gates, Dennis Bldg., Granville St. General contractors, S. A. Marshall & Son, Keith Bldg. Plumbing, G. A. Perrier, 33 Granville St.

Kingston, Ont.
Church, cost $23,620, for First Baptist Church Congregation. Pastor, Rev. Douglas Laing, Johnson St. Architect, Arthur Ellis, King St. General contractor, J. M. Litton, 81 Frontenac St. Elec. wiring and fixtures, The H. W. Newman Elec. Co., 70 Princess St. Pews will be supplied by the Valley City Seating Co., Dundas, Ont.

Melville, Sask.
School, cost $20,000, for Melville School Dist. No. 2187. Secretary, A. B. Bargmann. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg, Regina. General contractor, carpentry, iron and steel and roofing, A. B. Cunningham. Heating and plumbing, J. Dawd, 2nd Ave. Painting and interior fittings not yet let. Four rooms, brick construction and foundation.

Montreal, Que.
Hall alterations, cost $5,500, Hutchison and Sherbrooke, for Royal Guardian Society, 227 Sherbrooke W. General contractor, W. M. Irving, Guy Block. 4 storeys, 50 x 70, felt and gravel roofing. Portion of front wall and side to be taken down and rebuilt. General repairs to be made.

Grenadier Guards Armoury, Esplanade planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architects, MacVicar & Heriot, 104 Union Ave. General contractor, D. G. Loomis, St. Patrick St.

Oakville, Ont.
Addition to Sunday School for St. Jude's Anglican Church. Pastor, Rev. H. F. Woodcock. General contractor, A. F. Ford.

Preston, Ont.
Post office, cost $45,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor and carpenter, Geo. A. Proctor, Sarnia. Mason, Edward McDonald, Sarnia. Painting, Simpson & Carter, Sarnia. Heating and plumbing, Brown & Semple, Brockville. Three storeys, red pressed brick construction, galvanized iron, felt and gravel roofing. Foundations in.

Roseisle, Man.
School. Sec.-treas., W. D. B. Voyd. Architect, E. T. Tuttle, 701 McArthur Bldg., Winnipeg. General contractor, Fred Krauer, Roseisle or 334 Edmonton St., Winnipeg. One storey and basement frame construction, concrete foundation.

Toronto, Ont.
Alterations to building for theatre, 593-5 Yonge St., for Amalgamated Picture Shows Ltd., 603 Traders Bank Bldg. Architect, Neil G. Begg, Cosgrave Bldg. General contractor, A. H. Garrett, Peterkin Bldg.

Theatre, cost $6,000, Bathurst and Alcina. Owners and general contractors, Allen & Ryan, 654 Annette St. Architect, E. R. Conlan, 73 Glendale, will sublet. Two storeys, 28 x 108, steel and brick construction, stone foundation. Store fronts, heating.

Enlargement of school, cost $5,000, Parkdale. Mason and carpenter, Forbes Slater. Roofing, J. T. Flowers, 200 Markham St. Plastering, G. White, 688 Kingston Rd. Painting and glazing, Jas. Casey, 30 Dalhousie. Board of Education. Sec.-treas., W. C. Wilkinson, City Hall.

Winnipeg, Man.
Alterations and addition to club, cost $50,000, Broadway, for Adanac Club, Main St. S. Architects, Pratt & Ross, Electric Railway Chambers. General contractors, National Construction Co., 307 Donalda Bldg.

Addition to grain exchange, cost $500,000, Lombard St. for Traders Building Association, Grain Exchange Bldg. Architects, Jordon & Over, Canada Life Bldg. General contractors, Carter-Halls-Aldinger Co., Union Bank Bldg.

Business Buildings and Industial Plants

Beebe, Que.
Hotel contemplated by J. E. Perkins, Rock Island, Que. Plans will be prepared.

Calgary, Alta.
Laundry planned for Ontario Steam Laundry Co., 5th ave. and 2nd street. Proprietor, Christie Bros. Architect, D. S. McIllroy, 118a 8th Ave. W. Tenders will not be called immediately.

Chatham, Ont.
The Chatham Mfg. Co. has taken over business of the Chatham Malleable Iron & Steel Mfg. Co. and will build large addition to plant in near future.

Fenelon Falls, Ont.
Sash and door factory contemplated for Dyment & Mickle, lumber merchants. Plans will be prepared, also three or four workmen's houses.

Joliette, Que.
Bank bulding planned for Canadian Bank of Commerce. Further information from M. Durand, Joliette.

London, Ont.
Addition to factory, cost $20,000, contemplated for London Foundry Co. Manager, W. Grobb. Architect to be selected. Work may be started this fall. Machinery required for manufacturing churns, wheelbarrows, etc. Two storeys, white brick construction.

Magog, Ont.
Business block planned for Hamel & Leduc. Foundation, M. Thomas. General contract not awarded.

Montreal, Que.
Loft building, ten storeys, Alexander and Mayor, contemplated for Commerce Freehold Investment Company. Manager, S. A. Grant, 75 Bleury. Building to be built next summer when present leases expire.

Garage, cost $3,000, Belvedere Road, for F. C. Wilson, 46 Belvedere Rd. Tenders received by architects, Saxe & Archibald, 59 Beaver Hall Hill. Two stys., 25 x 35, concrete foundation, concrete & brick construction.

Ogena, Sask.
Hotel, cost $20,000, for Mr. West. 3-storeys, 100 x 90, frame construction. Plans ready.

Ormston, Que.
Milk factory for Borden Condensed Milk Co., Huntingdon, Que. Plans in progress.

Ottawa, Ont.
Printing Bureau building planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Government propose to tear down old building and replace it by larger building on another site.

Pitt Lake, B.C.
Rock crushing plant, cost $100,000 planned. The British Columbia Transport Co. are spending $100,000 improving and adding to its plant.

Sarnia, Ont.
Match factory, cost $30,000, for Sommers Bros., Saginaw, Mich. Plans will be prepared.

Factory, cost $150,000, Christina and Clifford, contemplated for Perfection Stove Co., c/o Cleveland Foundry Co., Cleveland, Ohio. Site purchased, ten acres, 3 buildings. By-law will be submitted.

Toronto, Ont.
Hotel and restaurant, 111-3 Bay St., contemplated for E. G. McConkey, 20 King. W. Board of License Commissioners will grant transfer of license. Work to start by December 1st.

Fertilizer, cost $15,000, Syme Road, planned for Gunns Ltd., Gunns Road, West Toronto. Tenders now open for galvanized iron fertilizer. Particulars from E. N. Brown.

Store and residence, cost $3,000, Lamb and Mt. Joy, planned for H. Rowe, 6 Ivy ave. Two storeys, 18 x 42, brick and steel construction, brick foundation, felt and gravel roofing.

Vancouver, B.C.
Warehouse, cost $7,000, for Royal

(Continued on page 73)

Tenders and For Sale Department

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Repairs to Eastern Pier at Newcastle, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 15, 1913**, for the Repairs to Eastern Pier at Newcastle, Durham County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmasters at Kingston, Ont., and Newcastle, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46374. 39-40

Sealed tenders addressed to the undersigned and endorsed "Tender for Examining Warehouse, Fort William, Ontario," will be received at this office until 4 p.m., on **Tuesday, October 14, 1913**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the offices of Mr. H. E. Matthews, Superintending Architect of the Dominion Public Buildings, in the Province of Manitoba, Winnipeg, Man.; W. P. Merrick, Esq., District Engineer, Fort William, Ont.; at the office of the City Clerk, Fort William, Ont.; and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 11, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47782. 39-40

Stratford's Water Commissioners Invite Separate Bids for the Supply of

(a) A 150 h.p. steel boiler to carry a 120 lbs. working pressure. The offer to be accompanied by full specifications and drawings showing the type, sizes, fittings, foundation and setting.

(b) Also, for a similar boiler capable of 150 lbs. working pressure.

(c) Also, for one high duty reciprocating steam pump, to deliver 1¼ million imperial gallons of water per 24 hours at 80 lbs. pressure. Preference will be given to a pump that could do this duty economically, and yhe when required for fighting fire, could get 120 lbs. water pressure. This offer to be accompanied by full specifications and drawings that show the foundation.

The Commissioners will be at the cost of putting in all foundations and steam pipes, but not of steam shut-off valves for each. All metal work must be put together by the contractor, and delivered here f.o.b.

Time for delivery—from acceptance of bid—six weeks.

Bids to be in on or before the 4th of October, 1913.

The lowest or any bid not necessarily accepte.

W. H. TRETHEWEY,
39-40 Sec.-Treas. Water Commissioners.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf Extension and Warehouse at Barcebridge, Ont.," will be received at this office until 4 p.m. on **Tuesday,** October 21, 1913, for the construction of a Wharf Extension and Warehouse at Bracebridge, District of Muskoka, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. H. Armstrong, Esq., District Engineer, Midland, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Bracebridge, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation, and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. Desrochers, secretary.

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 22, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47003. 39-40

Department of Militia and Defence

Kingston, Ont. – Rifle Range

Notice to Contractors

Sealed tenders, marked on the envelope "Tender for additions to Rifle Range, Kingston, Ont." and addressed to the Director of Contracts, Militia Headquarters, Ottawa, will be received until noon, 11th October, proximo, for the construction of an extension to the Rifle Range at Kingston, Ont.

Plans and specifications may be seen and full information obtained at the offices of the Officer Commanding the 3rd Divisional Area, Kingston, Ont., and the Director General of Engineer Services, Headquarters, Ottawa.

Tenders must be made on forms supplied by the Department and each tender must be accompanied by an accepted cheque on a Canadian Chartered Bank for 10 per cent. of the amount of the tender, payable to the order of the Honourable the Minister of Militia and Defence, which amount will be forfeited if the party tendering declines to enter into or if the Contractor fails to complete his contract in accordance with the tender.

The Department does not bind itself to accept the lowest or any tender.

EUGENE FISET, Colonel
Deputy Minister.

Department of Militia and Defence,
Ottawa, September 18, 1913.

Newspapers will not be paid if they insert this advertisement without authority from the Department.
H.Q. 18-114-2.—48030. 40

Sealed tenders addressed to the undersigned, and endorsed "Tender for Examining Warehouse, Port Arthur, Ont.," will be received at this office until 4 p.m., on **Tuesday, October 14, 1913**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of the City Clerk, Port Arthur, Ont.; F. Y. Harcourt, Esq., District Engineer, Port Arthur, Ont.; H. E. Matthews, Esq., Superintending Architect of the Dominion Public Buildings, Winnipeg, Man.; Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Cor. Yonge and Charles streets, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 11, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47781. 39-40

Tenders for Cast Iron Pipe, Valves, and Special Castings

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on

TUESDAY, OCTOBER 21st, 1913,

for 20-inch CAST IRON PIPE, 36-inch CAST IRON PIPE, 36-inch and 20-inch STOP VALVES, and 36-inch and 20-inch CAST IRON SPECIAL CASTINGS.

Specifications and tender form for the foregoing may be obtained upon application at Room No. 9, Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal. Tenderers shall submit with their tenders the name of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
City Hall, Toronto, Sept. 24, 1913. 40

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, October 7th, 1913**, for the construction of the following works:—

SEWERS

East Toronto Outlets—Eastern Ave. Connection.

Lightbourne Ave., from Brandon Ave. to Chandos Ave.

Chandos Ave., from Lightbourne Ave. to 437 feet west.

Belsize Drive, South from Tullis Drive to Yonge Street.

Morrison Ave., from Dufferin St. to Harvie Ave.

Wells Hill Ave., from Nina St. to North Limit of Lot No. 1.

Lane 1st N. College St., from Crawford St. to Shaw St.

Lane 1st N. of Dundas St. Heintzman Street to Keele Street.

Lane 1st S. of Bloor St., from Borden Street to Brunswick Ave.

Beech Ave., from Queen St. to Kingston Rd.

Esplanade Sewer Sanitary Contract No. 87, Section No. 1.

Woodville Ave., Bloor St. to Conduit St.

Danforth Ave. S. O. S. Sec. No. 1, Logan Ave. to Don River.

Earlscourt Drainage System No. 2, Davenport to Station St.

Esplanade—Princess St. to Scott St.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties, approved of by the City Treasurer, or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid. Conditions relating to tendering as prescribed by the City By-law must be complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, Sept. 25th, 1913. 40

ARCHITECT

For an experienced, up-to-date architect, an excellent proposition is offered, by an established Consulting Engineering & Architectural Corporation, based on a co-operative plan, offices in Cleveland, Detroit, Buffalo and New York City. The position requires a man who is thoroughly capable of handling an architectural department independently, both inside and outside work. Highest references and $1,500 investment required. Contract with salary, commission and interest in business guaranteed. Answer, "Architect," Contract Record, Toronto. 40

TO ARCHITECTS

Masonic Temple, Toronto

Competitive designs for the above will be received up to noon on the **20th** day of January, **1914**, The conditions of competition have been prepared by a competent professional adviser who will also report upon the merits of the various designs. For copy of Conditions apply to Mr. W. H. Best, No. 181 Avenue Road, Toronto. 40-41

Debentures for Sale

$17,955.98. Town of Pembroke 4½ per cent. Bonds. Viz.:—

$8,500 for extension of waterworks system, maturing 20 years from September 6th, 1912, interest payable annually at Bank of Ottawa, here.

$5,000 for bonus to manufacturing industry, payable in 20 annual instalments from February, 1913.

$4,455.98 for local improvements, due in ten years from July, 1913, interest payable annually.

Offers for the purchase of above debentures, including accrued interest, addressed to W. H. Bromley, Esq., will be received up to October 15th. Delivery of Bonds at Bank of Ottawa here.

A. J. FORTIER,
40-41 Town Clerk.

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Business Buildings and Industrial Plants

(Continued from page 71)

Crown Soaps Ltd., 308 Harris. Plans ready.

Bank building, Pender and Main, contemplated for the Canadian Bank of Commerce. Have purchased site and plans will be prepared.

Winnipeg, Man.

Store, cost $2,800, for A. Dagdick, 79 Euclid. One storey, 33 x 45, brick construction, cement foundation. Plans ready.

Garage, cost $4,000, Wellington Cres., for H. W. Hutchison, Wellington Cres. Two storeys, 23 x 34, brick construction, cement foundation. Plans ready.

CONTRACTS AWARDED

Amherst, N.S.

Alterations to bank, cost $6,000, Victoria, for Canadian Bank of Commerce. Architect, J. L. Allen. General contractor, J. E. Lusby. Heating, J. L. Allen, Stone and brick front, metal cornices, vaults, bank fixtures.

Berlin, Ont.

Shoe factory for Gourlay & Co., Kaiser St. General contractors, Secord & Sons, Brantford. Foundations in.

Berlin, Ont.

Wholesale grocery warehouse for J. Sloan Co., Church St. Architect, C. Knechtel. Mason, J. Baetz, Mill St. Carpenter, G. Bucher. Work to start at once.

Brantford, Ont.

Factory core room, cost $8,000, So. Market St., for Massey Harris Co., Ltd., Manager, F. Grobb. General contractor, A. J. Cromar, 448 Colborne. Three storeys, 42 x 92, brick construction, concrete foundation, reinforced concrete roofing and floors, steel joists and rafters.

Calgary, Alta.

Office building for Imperial Oil Company, 401-2 Alta. Loan Bldg. District Manager, P. W. Gordon. Architect and general contractors, The Alliance Investment Co., 711 1st street west.

Edmonton, Alta.

Office building for E. S. McQuaid, 507 Stephen Ave. Architect, E. C. Hopkins, 32 Jasper ave. General contractors, Dunlop Johnson Construction Co., 205 Hart Bldg. Building to be completed by the spring. Excavating done.

Store and apartments, cost $6,000, 1st street. Owner and general contractor, R. J. Dykes, 1st and Clara. Architect, J. Grant. Frame construction. Foundations in.

Warehouse, cost $70,000, 8th St. and Peace Ave., for Nicholson & Bain, 656 3rd street. General contractors, Fyshe, McNeil, Martin & Trainer, Dominion Bank Bldg., Calgary. 50 x 134, concrete, pressed brick and mill construction.

Livery stable, cost $4,000, Queens. Architect and general contractor, L. J. Auten, 838 Government St. Two storeys, 33 x 110, frame and brick veneer construction. Foundations in.

Edgeley, Sask.

Barn, cost $9,000, for Mrs. A. K. Larsen. General contractor, J. Inglis, 1305 Montague St., Regina. 94 x 118, electric lighting.

Store, cost $3,000, Alberta ave. Architect and general contractor, W. J. Ross, 2040 Charles St. Two storeys, 26 x 50, frame construction. Foundations in.

Store and apartments, cost $23,000, 24th

St., for C. A. Law, 112 C. P. R. Bldg. Architects, Barnes & Gibbs, Imperial Bank Bldg. General contractors, Read, McDonald & Brewster, Tegler Block. Three storeys, 50 x 50, brick and stone construction, concrete foundation. Excavating started.

Fort William, Ont.
Warehouse, Donald St., for A. McDonald Co. Architect, W. A. Irish, 219 Kennedy Bldg., Winnipeg. General contractor and painting, G. H. Archibald & Co., Union Bank Bldg., Winnipeg. Cut stone, John Ross, Fort William. Metal forms for foundations, Concrete Forms Company, 212 Carlton Bldg., Winnipeg. Steel work, Manitoba Bridge & Iron Works Ltd., Logan Ave. W., Winnipeg. Roofing, Wells & Dibblin. Metal doors, etc., W. T. Grose, 905 Electric Railway Chambers, Winnipeg. Mill work, Geo. A. Matthews Sash & Door Co.

Halifax, N.S.
Stable, cost $30,000, Albermarle, for Moir's Ltd., Argyle St. Builder, Anglin's Ltd., 65 Victoria St., Montreal and Woodside, Halifax Co., N.S. Engineer, Mr. Morriscey, Woodside. General contractor, masonry and carpentry, builders. Two storeys, 125 x 60, cement foundation, reinforced concrete construction. Excavating done.

Hamilton, Ont.
Alterations to bank, cost $7,000, King St. E., for Metropolitan Bank, 74 James St. N. Architects, Watt & Blackwell, Lister Chambers. General contractor, R. Campbell, 117 Duke St. Brick construction, slate and tile roofing.

Three factory buildings for Grasseli Chemical Co., Ottawa St. General contractor, F. Kruse, c/o company. Frame construction, brick and concrete floors, tar and gravel roofing.

Addition to foundry, cost $5,000, for Sawyer-Massey Co., Wellington St. N. General contractor, Geo. E. Mills, 614 King St. E. Brick, concrete and iron construction, felt and gravel roofing.

Store, cost $5,000, King St., for B. H. Webster, Wentworth & King Sts. Architect, F. W. Warren, 808a Bank of Hamilton Bldg. General contractor, Stanley Kerr, 408 Garth St. One storey, 24 x 80, pressed brick construction.

Stores and apartments, cost $10,000, for T. W. Hand, 584 King St. W. Architects, J. A. Armes & Walter Scott, Federal Life Bldg. Mason, W. Inrig, 140 Flatt Ave. Carpentry, W. Whittaker, 17 William St.

Stores and hall, cost $25,000, Main St. E., for Royal Templars of Temperance, Spectator Bldg. Architect, W. A. Edwards, 7 Hughson St. S. Mason, Geo. E. Mills, 614 King St. E. Carpentry, J. Evans, 237 Hunter W.

Two stores and apartments (alterations) cost $4,000, for Lees, Hobson & Stephens, Bank of Hamilton. Builder, R. G. Wilson, 4 Rutherford ave. Three storeys, store fronts and fixtures.

Lake Megantic, Que.
Broom factory for P. Cliche. General contractor and mason, D. J. Bonin. Carpentry, Ely Dion. Stone foundation, red brick construction. Excavating done.

Medicine Hat, Alta.
Extension to mill, cost $2,500. Architects and general contractors, Alberta Rolling Mills, Pacific Ave. 1½ storey, 40 x 45, structural steel and iron construction. Foundations in.

Montreal, Que.
Stables, cost $10,000, for Toilet Laundry, 423 Richmond St. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg. General contractor, A. F. Byers, 340 University. Tenders will be called about Oct. 15th for roofing.

Office repairs, cost $6,000, 231 St. James, for American Express Co., McGill St. Architect, H. Harwood, c/o Freeman's Hotel. General contractor, Geo. Roberts, 79 Lagauchetiere. Required, quartered oak, oxidized and ord. brass.

Office building for Sun Life Assurance Co., 142 Notre Dame W. Architects, Darling & Pearson, 2 Leader Lane, Toronto. Excavation and foundation, Jno. Quinlan & Co., 4412 St. Catherine.

Stove foundry, cost $60,000, St. Laurent, for Can. Stove and Furniture Co., Ltd., Delorimier ave. Architect, W. A. Mahoney, Guelph, Ont. General contractor, Jas. Shearer Co., 225 St. Patrick. Heating and plumbing tenders received by owners.

Factory addition, cost $5,000, for Frisco Soda Water Co., 1514 Clarke St. Builders, owners. Addition of second storey, 40 x 100, frame and brick construction.

Warehouse, cost $10,000, for Canada Sugar Refining Co., 150 Montmorency. General contractors, Jas. Shearer & Co., 225 St. Patrick. Pile driving, W. A. Wood, 246 Pine W. One storey, 50 x 100, concrete foundation, brick construction, felt and gravel roofing.

Ottawa, Ont.
Stables and garage, cost $10,000, St. Andrew, for A. E. Rae Co., Ltd., Rideau St. Architects, Ross & MacDonald, 1 Belmont St., Montreal, Que. General contractors, Doran & Delvin, Rae Bldg., Ottawa. Solid brick construction, stone and concrete foundation.

Rouleau, Sask.
Business block, cost $5,000, for W. F. Krauss, Main St. General contractor, E. E. Poole, Railway ave. 2½ storeys, brick construction, concrete foundation.

Regina, Sask.
Boot and shoe warehouse, cost $45,850, for W. G. Downing Shoe Co. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg. General contractor, Thos. Barnard, 211 Westman Chambers. Foundations in.

St. John, N.B.
Warehouse, cost $15,000, Union, for M. E. Agar, Commr. Public Works, City Hall. Work being done by day labor. Foundations in.

Bank building, Main, for Royal Bank of Canada. Manager, J. B. Blair, King St. Architect, K. G. Rae, Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke St. Granite and freestone work, British American Construction Co., Prince William St.

Sydney, N.S.
Warehouse and office, cost $7,000, for Chappell Bros. & Co., Ltd., Brooklyn St. General contractors, masonry, carpentry and interior fittings, owners. Painting, heating, plumbing and electric not awarded. Three storeys, 45 x 40. Foundations in.

South Edmonton, Alta.
Stores, cost $10,000. General contractors and architects, Canadian West Commercial Co., 24 1st street. Two storeys, 33 x 80, brick construction, concrete foundation. Excavating done.

Ste. Anne De La Pocatiere, Que.
Stables for Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractor, Fortin Freres & Mercier, St. Henri, Levis Co. Stables at Experimental Farm.

Toronto, Ont.
Four attached stores and residences, cost $12,000, Bathurst and Alcina. Owners and general contractors, Allen & Ryan, 73 Glendale ave. Architect, E. R. Conlan, 73 Glendale. Two storeys, 72 x 54, steel and brick construction, stone foundation, felt and gravel roofing. Excavating started.

Bank, cost $7,000, Parliament and Gerrard, for Merchants Bank of Canada, Wellington St. W. Architect, C. J. Gibson, 53 Yonge St. Mason, J. W. Gratton, 488 Clinton St. Two storeys, 26 x 42, brick and steel construction, brick foundation.

Warehouse, Hagerman. Owner and general contractor, M. Sigal, 83 Elizabeth St. Architect, H. S. Kaplan, 41 Wolesley St. Owner buys material, work done by day labor. Painting, heating, plumbing and electrical, will sublet. 3-storeys and basement, 40 x 70, brick and frame construction, brick foundation.

Victoria, B.C.
Hotel, cost $18,000, Humboldt Street, for White Horse Hotel, 800 Humboldt St. Architect, J. C. M. Keith, 416 Sayward Bldg. General contractors, Parfitt Bros., 1303 Gladstone.

Windsor, Ont.
Stores and flats, cost $35,000, for A. St. Dennis, 155 London St. W. Architects, Atcheson & Adams. Masonry and carpentry, Busch & Appleman, Windsor. Iron and steel, Can. Bridge Co., Walkerville. Roofing, F. Dresch & Son, Windsor. Heating and plumbing, Robt. Paddon. Two storeys, 70 x 110.

Store and apartments, cost $5,000, Mercer and Brant, for A. Abramson. Architects, Atcheson & Adams. General contractors, Busch & Appleman. Plumbing, Robt. Paddon. Two storeys, 37 x 26.

Winnipeg, Man.
Hotel for Olympia Cafe Co.; 217 Portage Ave. Architects, Jas. Chisholm & Sons, Enderton Bldg. General contractors, Carter-Halls-Aldinger Co., Union Bank Bldg. Architect is altering plans from cafe and office building to hotel. Steel work up.

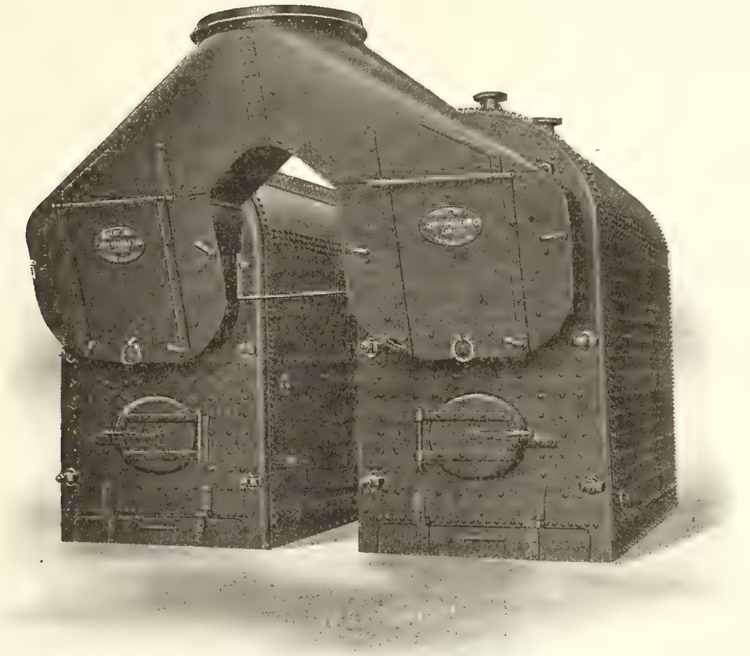
Stores and apartments, cost $35,000, College and Main, for W. B. Chambers. Architect, Chas. S. Bridgeman, Canada Life Bldg. General contractors, Simmons Bros., 1200 Garfield ave.

Residences

London, Ont.
Residence, cost $5,200, Queen's Ave. Tenders received by architects, McBride & Gilbert, Edge Block. Two storeys, 20

BOILERS

of all kinds



"Inglis" Boilers with proper care will last a life time.

Write us for prices, Photos, &c.

Canadian Manufacturers of Erie City Water Tube Boilers.

The John Inglis Company
Limited
Engineers and Boilermakers
14 Strachan Avenue - Toronto, Canada

x 51, white brick construction, concrete foundation. Plans drawn.

Montreal, Que.
Residence, cost $10,000, Dorval Island Tenders received by architects, Blanchard & Conrad, 3 Beaver Hall Sq., Montreal. Specifications not ready yet. Stone foundation, frame construction. Probably private electric motor run by gasoline engine will be used for electric lighting.

Ottawa, Ont.
Residence, cost $10,000, Main, for A. Chapentier, 141 Main St. Brick veneer construction, stone and concrete foundation. Plans in progress.

Residence, cost. $4,500, Anderson, for Harry Cheetham, 73 Anderson St. Two storeys, brick veneer construction, stone foundation. Plans in progress.

Toronto, Ont.
One detached residence, cost $6,500, for Alex. Hunter, Alexandra Blvd. 2½ stys. 26 x 32, brick construction, stone foundation. Plans ready.

Vancouver, B.C.
Residence, cost $75,000, Shaughnessy Heights, for A. E. Tulk, Canada Life Bldg. Architects, Maclure & Fox, Pacific Bldg. 2½ storeys and basement, brick and stone construction, steel casements. Permit issued.

Residence, cost $30,000, for H. Bingham, 2063 Grant. Architect, G. B. Kauffman, Davis Chambers. Hollow tile, frame and stucco construction. Tenders called.

Wininpeg, Man.
Two residences, cost $10,000, Ethelbert, for L. J. Hall, 98 Sherbrooke. 2½ storeys, 27 x 33, brick construction, stone foundation. Plans ready.

CONTRACTS AWARDED

Davidson, Sask.
Residence, cost $5,000. Owner and general contractor, R. A. Norris, Garfield St. 2½ storeys, brick and frame construction, brick foundation. Excavating done.

Edmonton, Alta.
Residence, cost $5,000, for Dr. W. A. Wilson, 640 13th. General contractor, J. Hay, 152 Henry St. Two storeys, 30 x 32, frame and brick construction, concrete foundation. Excavating done.

Residence, cost $17,500, Riverside Drive. Architect and general contractor, Mrs. L. Frederick, Capital Hill. 1½ storeys, 32 x 52, frame construction, concrete foundation. Excavating done.

Apartments, cost $20,000, 12 street, for Miss L. Grice. Architect and general contractor, S. H. Muttart, Muttart Block. Two storeys, 44 x 85, frame construction, brick foundation, felt and gravel roofing. Excavating done.

Hamilton, Ont.
Residence, cost $5,000, Westmoreland, for H. F. Blain, Sherman ave. Architect, F. W. Warren, Room 808, Bank of Hamilton Bldg. Mason, J. C. Zimmerman, Burlington. Carpentry, R. C. Jones, Maple ave. Two storeys and basement, 40 x 26, pressed brick construction.

Montreal, Que.
Flats, cost $30,000, Verdun (1st ave.) Architect, builder and general contractor, J. A. Leclair, 276 Church Ave. Work to start about Oct. 1st. Owner wil lsub-let some trades. Three storeys, 150 x 40, brick construction, concrete foundation.

Flats, cost $5,000, Orleans. Owner and general contractor, Jos. Parenteau, 3527 De Souligny, Parc Terminal. Three storeys, 22½ x 40, concrete foundation.

Apartment house, cost $20,000, St. Luke. Architect and general contractor, Z. St. Pierre, 101 Chomedy Apt. 3. Three storeys, 37 x 42, concrete foundation, solid pressed brick construction. Excavating done.

Eight flats, cost $10,000, Maisonneuve, (Girard). Owner and general contractor, W. Pitre, 113 Bourbonniere. Three storeys, 45 x 55, concrete foundation, brick construction. Excavating done.

Three flats, cost $7,500, Maisonneuve (14th ave.). Owner and general contractor, E. Varin, 282 2nd ave. Three stys., 27 x 50, concrete foundation, felt and gravel roofing. Permit granted.

Six flats, cost $10,000, Orleans. Owner and general contractors, O. Borduas & P. Richard, 1197 Boyer St. and 151 Stadacona. Three storeys, 45 x 43, concrete foundation, brick construction, felt and gravel roofing.

Ottawa, Ont.
Residence, cost $5,500, Hastey ave., for Geo. E. Preston, 280 Elgin St. Architect, C. J. Burritt, 193 Sparks St. General contractor, R. W. Hamilton, 81 Echo Drive. Double brick veneer construction, stone foundation.

Residence, cost $6,000, Nelson St. Owner and general contractor, Walter J. Martin, 392 Nelson St. 2½ storeys, 36 x 46, double brick veneer construction, stone foundation. Excavating done.

Residence, cost $8,000, for Col. Sherwood, Daly Ave. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Ferguson & Lambert, King Edward. Painting, Geo. Higman & Son, 176 Rideau. Heating and plumbing, McKinley & Northwood, Rideau St. Electric, J. A. Ellacott, Bank St. Plastering not awarded.

Troonto, Ont.
Two pair residences, cost $10,000, Logan ave. Owner and general contractor, W. W. Hiltz, 682 Broadview ave. Owner sublets. 2½ storeys, 38 x 44, brick construction, stone foundation.

One pair residences, cost $5,000, St. Clair. Owner and general contractor, W. Pennock, 5 Burlington Cres. 2½ storeys, 36 x 42, brick construction, stone foundation.

Two detached residences, cost $6,000. Owner and builder, J. Richards, 75 Pleasant Blvd. 2 ½storeys, 20 x 42, brick construction, stone foundation. Excavating done.

Eight pair residences, cost $32,000, Beresford. Owners and general contractors, S. Solodinsky, 2122 Dundas street. Tenders received by owner for plumbing and wiring at once. Two storeys, 23 x 42, pair, brick construction, stone foundation.

Power Plants, Electricity and Telephones

Fenwick, Ont.
Electric lighting planned for Pelham Twp. Clerk, A. N. Armbrust, Ridgeville. To be lighted by Welland Electric Light Co.

Winnipeg, Man.
Motors and electrical apparatus, cost $26,500, Transcona, for Grand Trunk Pacific Railway. General contractors, Canadian Crocker Wheeler Co., St. Catharines, Ont. Apparatus for company's car shops.

Miscellaneous

Winnipeg, Man.
Lumber. Tenders received by Board of Control till Oct. 2, 1913, for 1,000,000 ft. B.M. lumber. Specifications at office of Engineer, H. N. Ruttan, 223 James Ave.

Business Notes

Amherstburg, Ont.
Ice house and sheds of Lake Erie Fish Co., Malden St., totally destroyed. Loss $10,000, partly covered by insurance.

Assiniboia, Sask.
Club cafe owned by J. MacDonald burned. Loss $6,500.

Brooks, Alta.
Cold storage warehouse owned by Pacific Cold Storage Co. destroyed by fire. Loss $7,500.

Durham, Ont.
Two stores owned by McFarlane & Co. burned. Occupants, McFarlane & Co., drug store; Black's hardware store. Total loss about $25,000; insurance $12,000.

Milestone, Sask.
Elevators of International Elevator Co. & C. K. Wilson burned, loss $11,000.

Roblin, Ont.
Stores and residences burned. Owners, John Hughes and R. E. Thompson. Several smaller buildings also destroyed. Loss $15,000, insurance $5,000.

Tavistock, Ont.
Presbytery of R. C. Church Congregation burned. Priest, Rev. Father Cantillon, Pickering. Loss $3,500; insurance $1,200.

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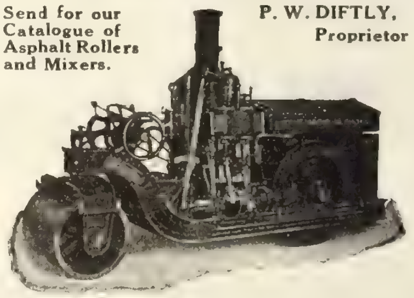
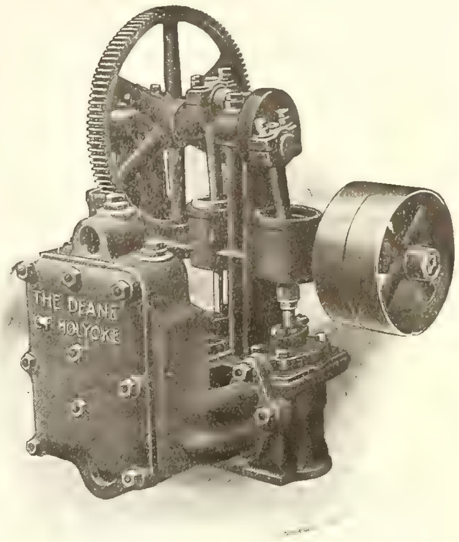
P. W. DIFTLY, Proprietor



"Our 20th Century Roller"

1303 Peach Street, - Erie, Pa.



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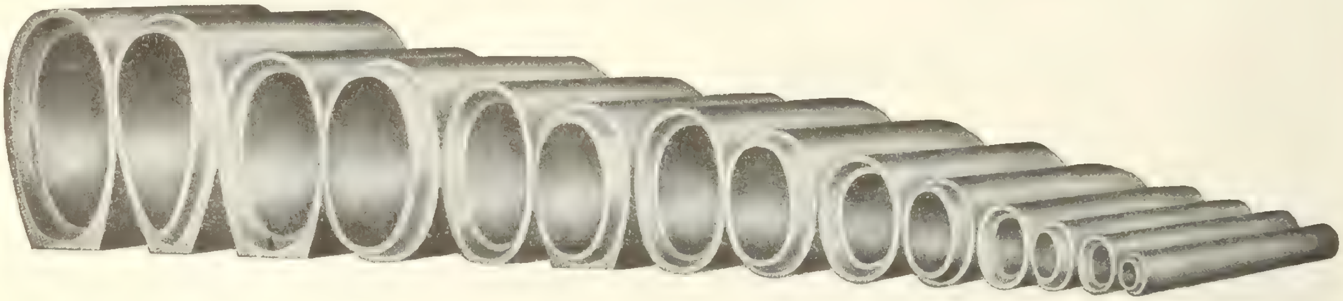

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STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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The Blystone Mounted Mixer with Power

You will do your concrete mixing quicker and cheaper with the Blystone Mixer. This is not what we alone say but what all users say. This mixer is adaptable to all kinds of work. We are willing to prove its advantages to you—give us the opportunity.

Simple, Durable and ALWAYS READY

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Steel Shingles

There is a great and growing demand for "Eastlake" Steel Shingles, because they make fire-proof, lightning-proof and weather-proof roofs that are very low in cost and will give longer service than any other roof yet produced.

These shingles have many strong points found in no others. Why not write to us for catalog R 2 and prices? It will pay you.

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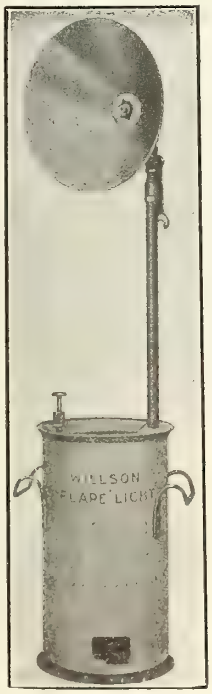

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SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

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1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

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Manufactured by

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Used Machinery and Contractors Plant

FOR SALE

1—40 H. P. Stationary Boiler and Engine
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1—1/2 Yard Milwaukee Concrete Mixer (New)
1—30 H. P. D. D. Electric Hoist
1—No. 4 Champion Stone Crusher
1—No. 5 Pulsometer Pump (New)
2—6x5 3/4x6 Duplex Pumps
1—Stone Elevator for No. 5 Austin Crusher
1—20 H. P. Upright Boiler
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1—14 H. P. White Traction Engine
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The above machines are but slightly used and are in good working order.

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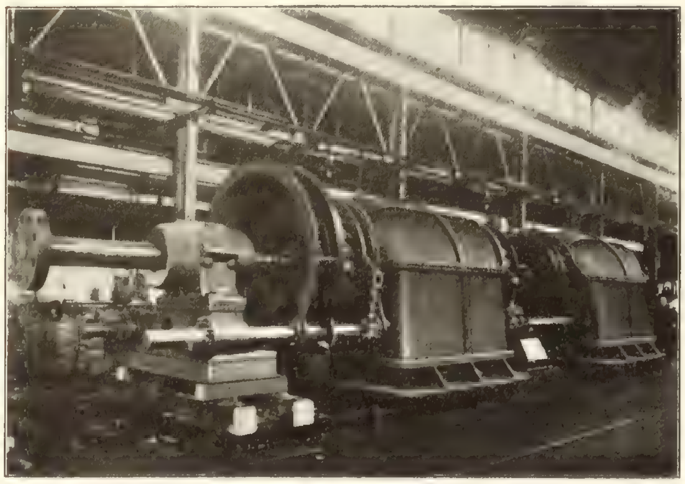
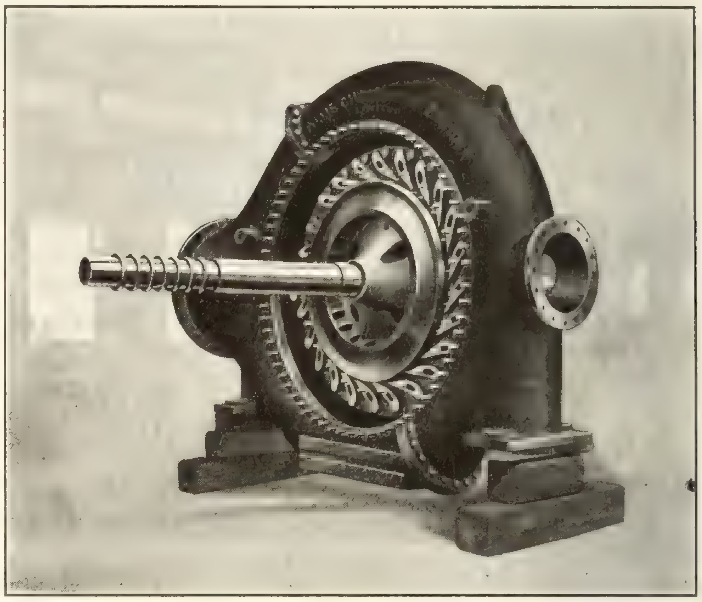
Specially designed and built to suit the conditions of operation



5,350 H.P. 237 R.P.M. 50 ft

These are illustrations of turbines under construction in our shops in Montreal. The upper is a quadruplex horizontal turbine, to be set in open concrete flume, under comparatively low head.

The turbine with cast iron spiral casing, shown below, is one of the type designed for higher heads. Part of the casing has been removed to show the runner and guide bases.



2,300 H.P. 250 R.P.M. 244 ft.

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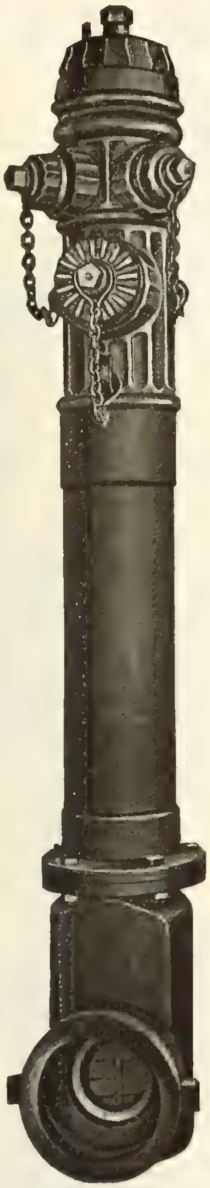

Kerr Gate Hydrant.

VALVES

- Brass Globe and Gate.
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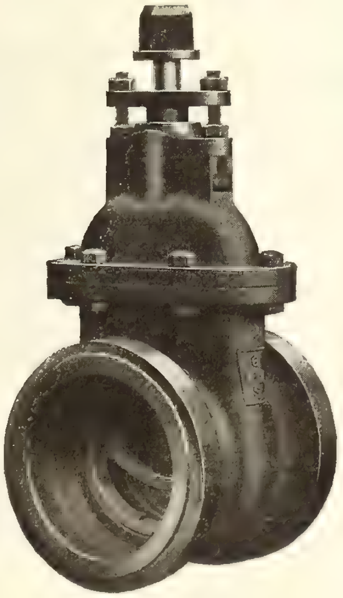

6" Hub End Gate

Forty Years of Experience has much to do with the satisfaction these goods give our customers.

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(REG. U. S. PAT. OFF.)

Economizers

The above is from a photograph showing a portion of the Economizer equipment for the Fiske Street Station of the Commonwealth Edison Company, of Chicago, Ill. Similar orders have recently been shipped or are in course of construction for

Cleveland Illuminating Company
Commonwealth Edison Company
Southern California Edison Company
Delaware & Hudson Railroad Company
Rochester Electric Ry. and Lt. Company

aggregating 31200 H.P., besides smaller installations.

These unqualified endorsements of Sturtevant Economizers by the largest and most representative power plants in the country are conclusive proof that all the advantages gained from fuel economizers are found in the STURTEVANT, together with numerous other advantages found ONLY in the STURTEVANT.

STURTEVANT ECONOMIZERS have the staggered arrangement of pipes which extract every possible heat unit from the escaping gas.

They have metal-to-metal joints which stand pressures up to 300 pounds and never give trouble.

The pipes may be removed without chipping or breaking, or disturbing surrounding pipes.

The scraper mechanism is positive in action, and fool-proof, the scrapers are interchangeable.

There are many other improvements in design and construction.

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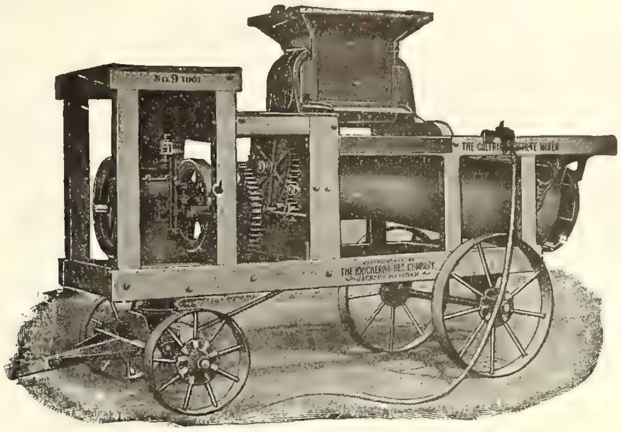

THE COLTRIN CONCRETE MIXER

FIRST OF ALL COMES ACCURACY. The contract stipulates a definite strength mix.

You as a contractor with a reputation at stake must adhere strictly to the specifications.

You can come close to it by using your wheelbarrows as a measure. But this method is not absolute. The loads vary as the men get tired. Real accuracy is impossible.

On the "Coltrin" each batch is mechanically measured to exactly meet the specifications. The amounts of sand, stone and cement are regulated the same as the flow of gasoline into the carburetor and just as accurately.

This is one of the reasons why architects and municipal engineers are so particular about specifying "Coltrin mixed concrete."

We want you to know what these architects and municipal engineers from all over the country have to say about the 'Coltrin." Send for their actual letters.

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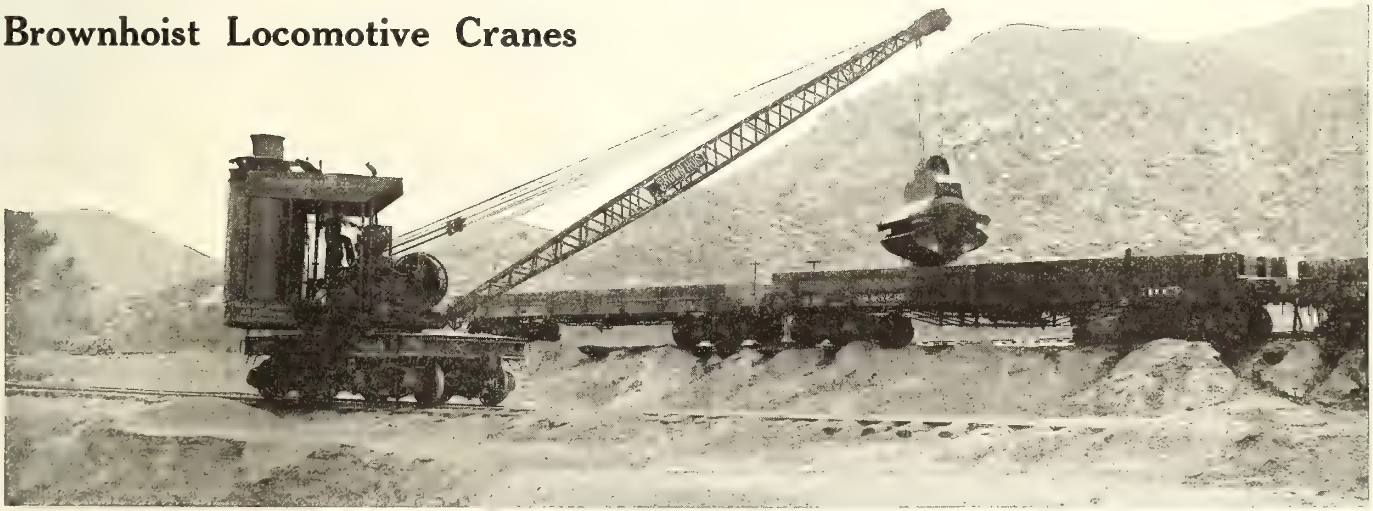
Brownhoist Locomotive Cranes



15-Ton Brownhoist Locomotive Crane used by the Independent Stone Co., San Diego, Calif.

If you handle stone, gravel, sand, coal, etc., you should investigate the use of Brownhoist Locomotive cranes for your work. Each crane, equipped with a Brownhoist Patent Grab Bucket, handles these materials 1 to 2 tons at a load, from and to stock pile, cars, boats, wagons and bins. And the crane also does the switching of the cars.

These cranes are being used in all sections of the country and you should investigate their operations.

Write for our new catalog K which shows how and where these cranes are being used.

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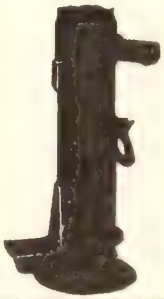

Made by practical Jack Builders. Material: best grades of malleable iron and steel Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

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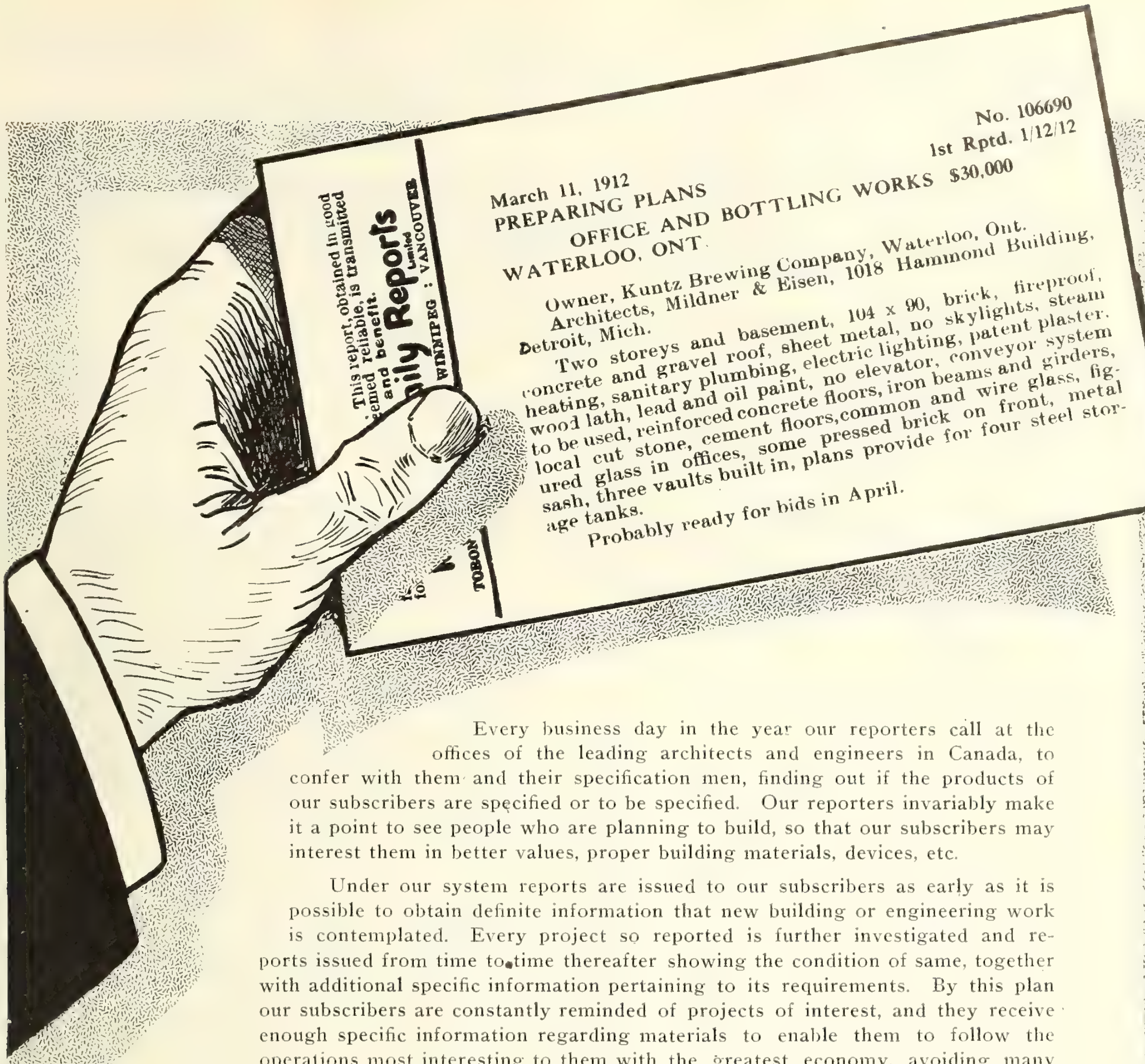

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March 11, 1912
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OFFICE AND BOTTLING WORKS $30,000
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Owner, Kuntz Brewing Company, Waterloo, Ont. Architects, Mildner & Eisen, 1018 Hammond Building, Detroit, Mich.

Two storeys and basement, 104 x 90, brick, fireproof, concrete and gravel roof, sheet metal, no skylights, steam heating, sanitary plumbing, electric lighting, patent plaster, wood lath, lead and oil paint, no elevator, conveyor system to be used, reinforced concrete floors, iron beams and girders, local cut stone, cement floors, common and wire glass, figured glass in offices, some pressed brick on front, metal sash, three vaults built in, plans provide for four steel storage tanks.

Probably ready for bids in April.

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GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

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Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

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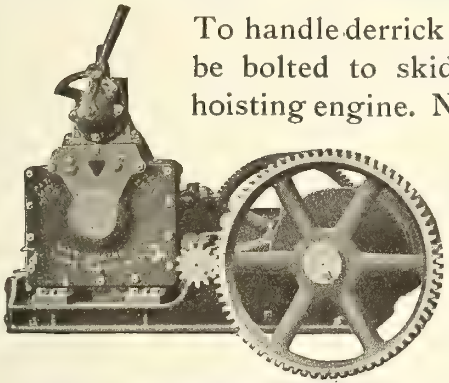

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Send us your specifications for Cut Stone work

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Hard Wall Plaster

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for Interior Construction

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The
Asphalt & Supply Company, Limited
Sole Canadian Agents for the Mexican Eagle Oil Co.
Also Agents for MASTIC ASPHALT for Sidewalks.
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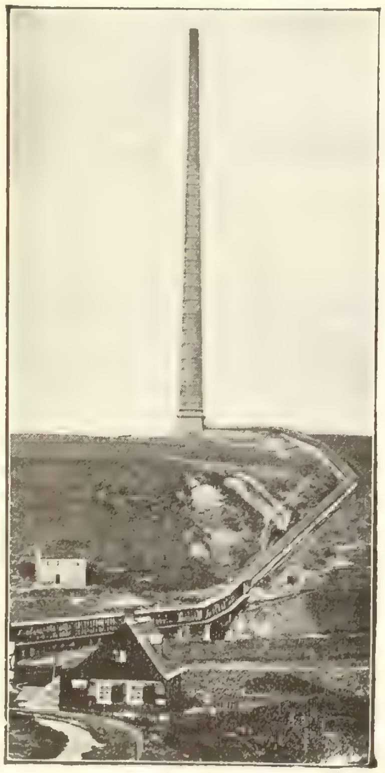

460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a **HEINICKE.**

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H. R. HEINICKE, INC. New York, U. S. A.
Representatives for Canada:
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Fresh Air for 9,000 People Delivered by ONE

"Sirocco"
TRADE MARK.
Ventilating Fan

The illustration shows a double inlet "Sirocco" Fan with a capacity of 270,000 cubic feet of air every 60 seconds at 5″ water gauge.

A "Sirocco" Fan will deliver twice as much air as the ordinary steel plate fan of the same wheel diameter. Save one-half the space and one-third the power.

"Sirocco" Fans and Blowers are made in sizes to deliver from 75 cubic feet per minute to 1,000,000 cubic feet per minute.

Our Engineering Department will gladly co-operate with you in the selection of the proper equipment for YOUR needs.

Let us tender on your next requirements. Bulletin No. 3401 is descriptive of the construction and operation of "Sirocco" Fans. You should have a copy.

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR, ONTARIO.

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E. C. POWERS, Room 5, 43 Victoria St., Toronto
W. P. EDDY, 214 Donald St., Winnipeg
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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

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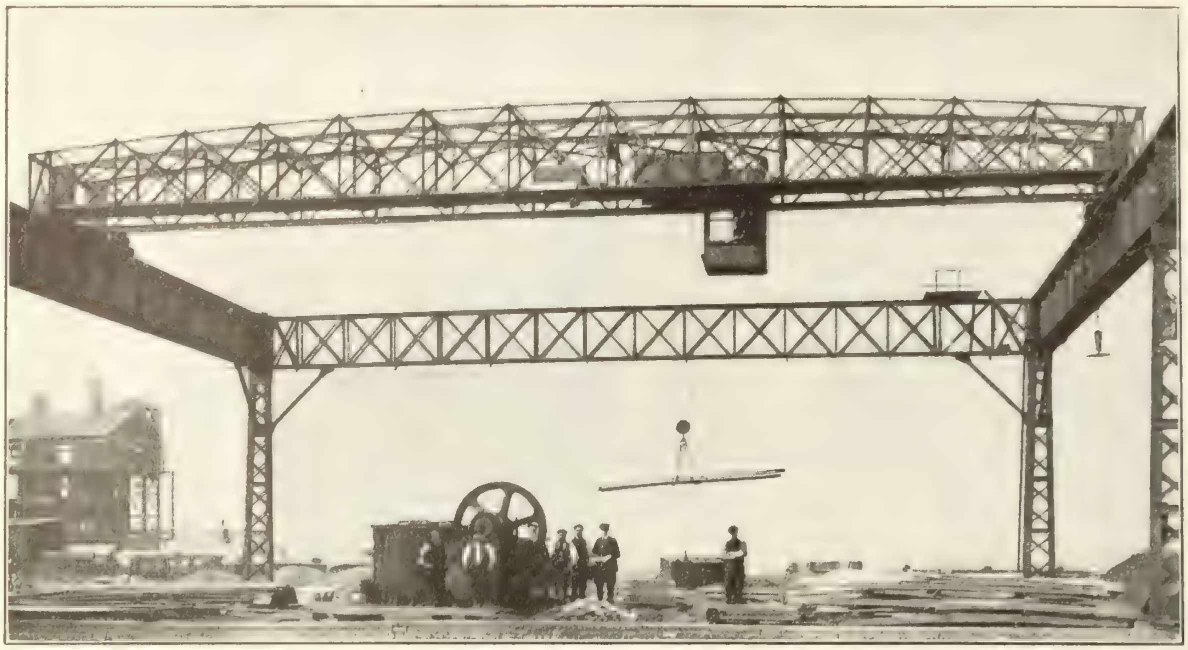

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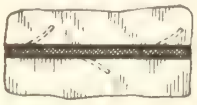
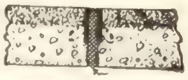


Longitudinal Section Showing Joint.



Cross-Section of Pavement Showing Expansion Joint.

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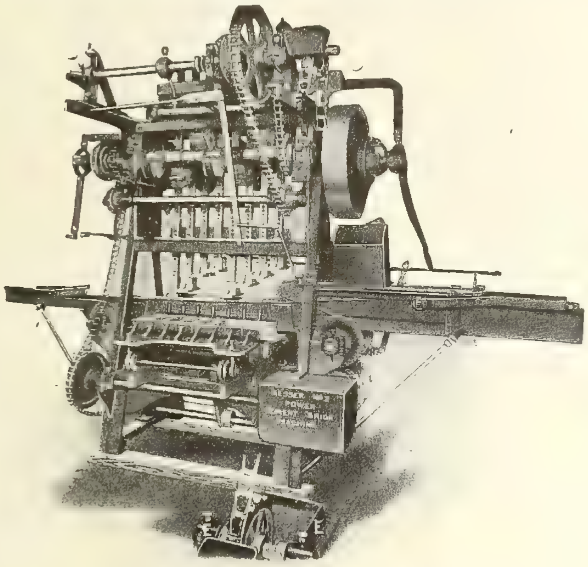

Besser Power Cement Brick Machine

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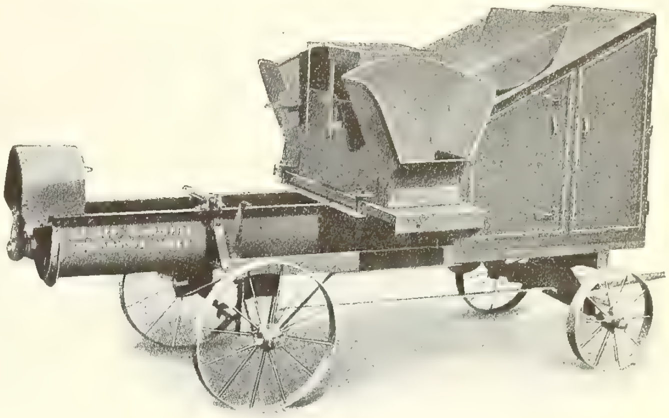

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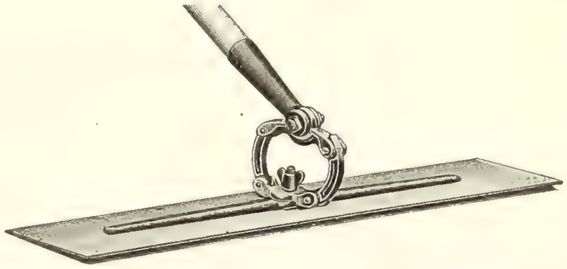

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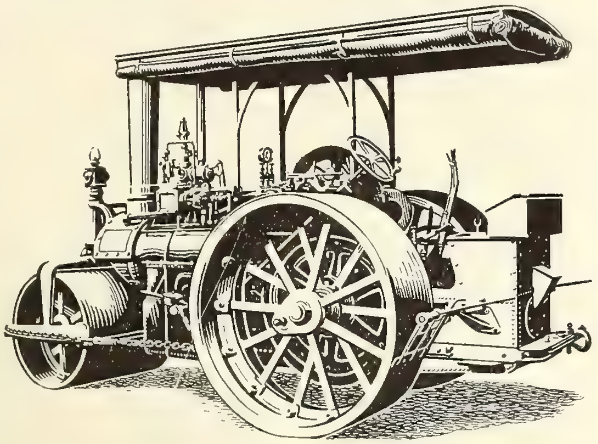

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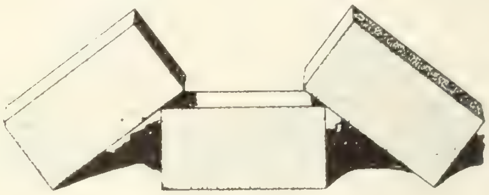

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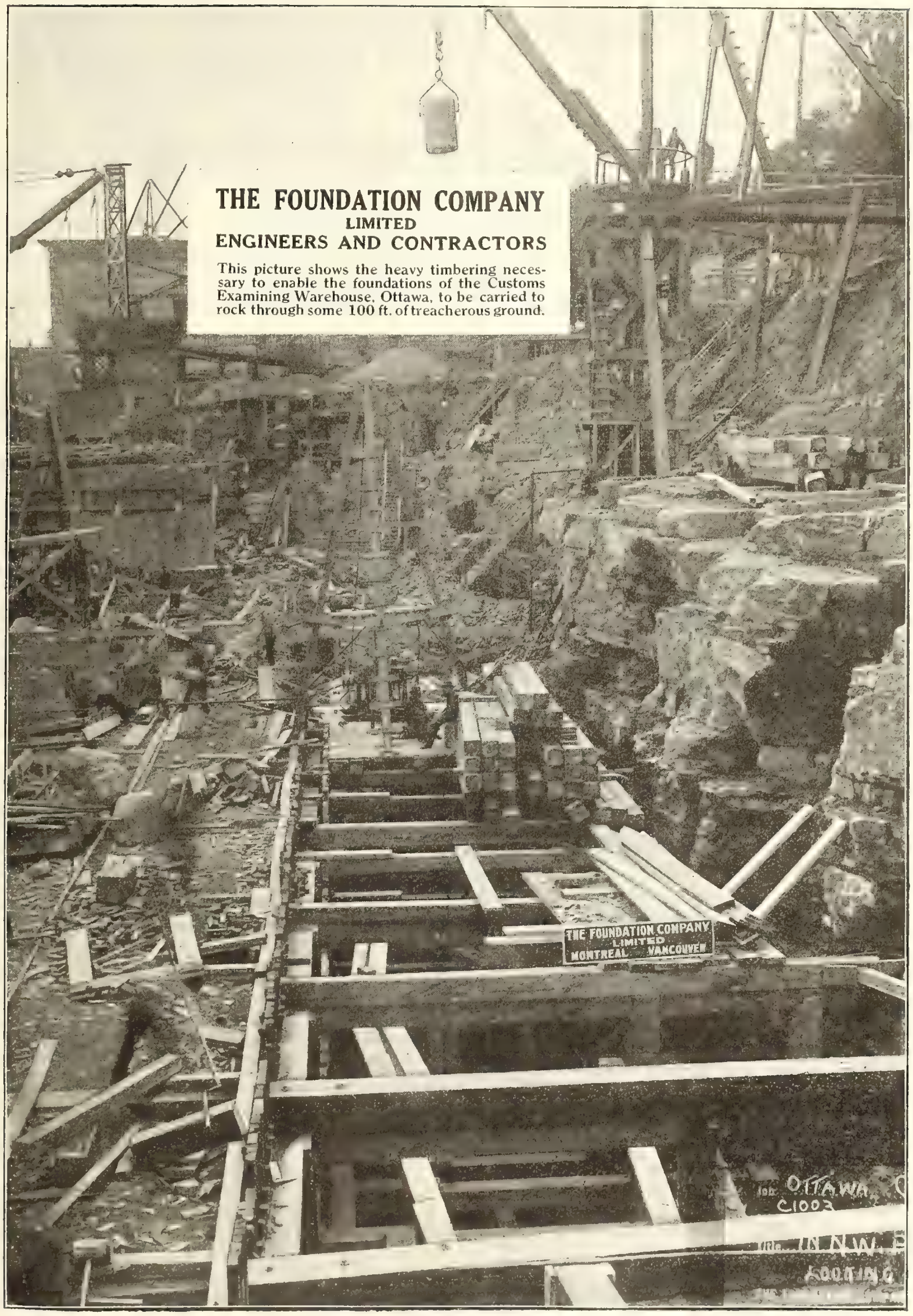

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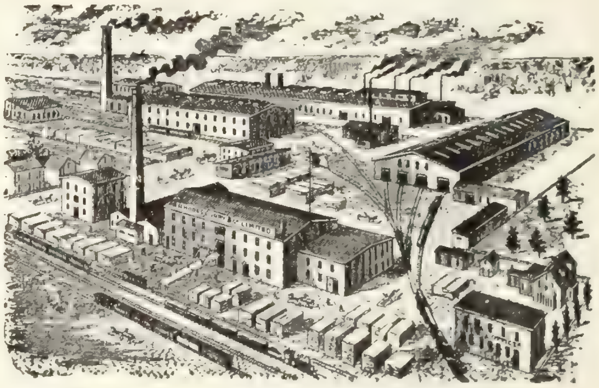

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Contractors who buy numbers of Hoists usually have to be convinced that what they are getting is "O. K."

The closer they examine and watch Beatty Hoists under severest conditions — the better pleased they are.

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If you place one Beatty Hoist on your work, you'll eventually buy more.

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Dipper Dredges
Clamshell Buckets
Steel Derricks
Clamshell Dredges
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Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

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All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

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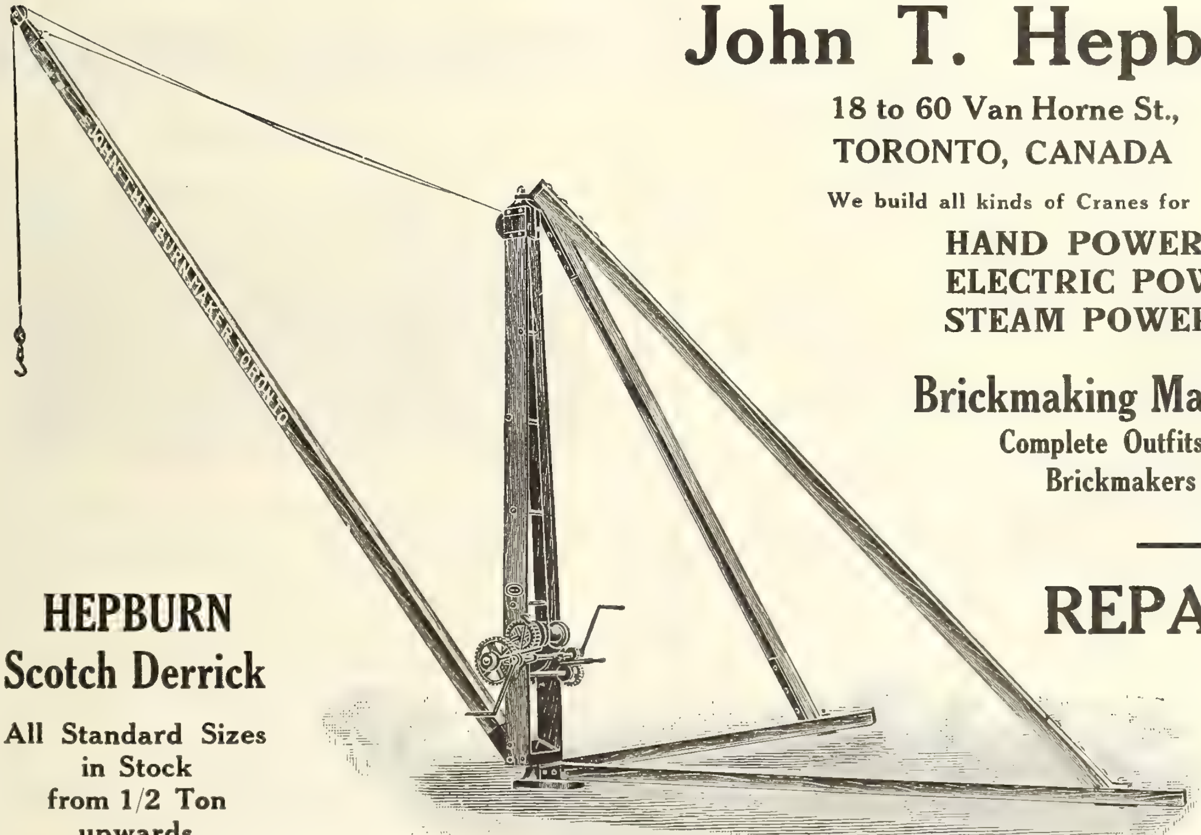
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Estimates furnished on application.

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OUR NEW WORKS: NORTH SHAW STREET
Main Structural Shop: 130 ft. x 400 ft.
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have been used and approved by nearly all leading Engineers. They are undoubtedly the most economical means of storing water at an elevation.

We have built many of these in Canada the United States and Mexico. Estimates cheerfully furnished.

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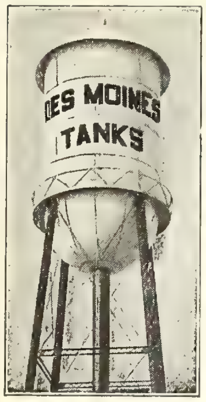

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ESTIMATES AND DESIGNS FURNISHED ON APPLICATION

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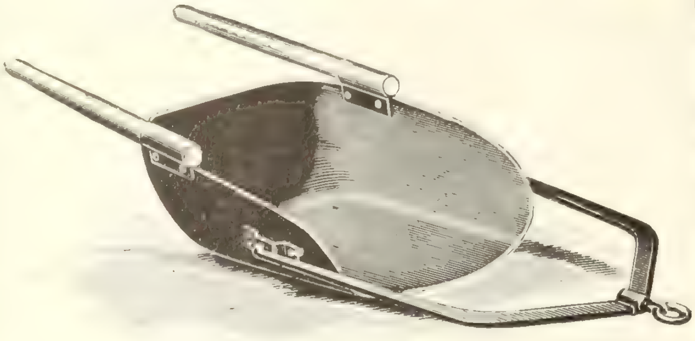

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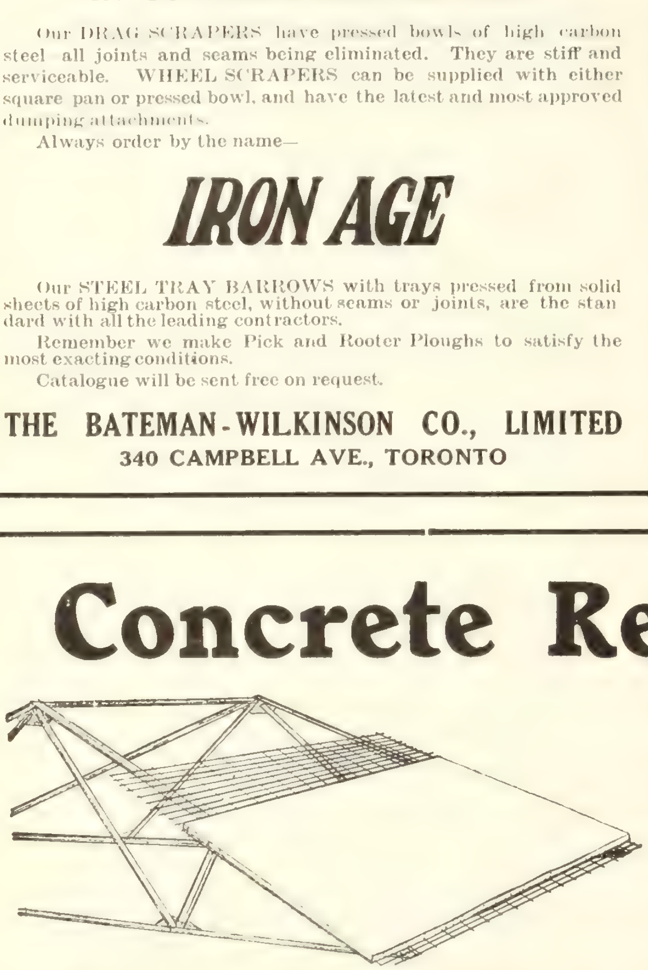

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Can be made in any Length or Width to suit you.

We claim in the erection of roofs and floors our continuous reinforcement has no superior, inasmuch as it knits the entire mass into an actual monolithic slab, weak at no point and so tied together that in case of accident from any cause whatever, no single section would fall but would be sustained by carrying capacity of wires running in continuous lengths over top of roof trusses or purlins.

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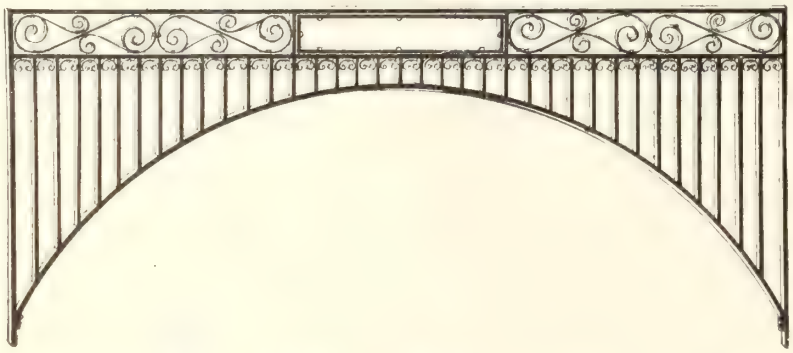

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SEND US YOUR ENQUIRIES
We specialize in
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OTTAWA PAINT WORKS
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AND OTHER INFORMATION

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

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More and Better Mortar with *Renfrew Lime.*

The brick-layers who use "Renfrew" lime for their mortar claim that it makes more mortar per 100 pounds of lime than any other brand on the market. And when it sets it is like a rock ensuring a permanent and clean-cut job. It is very easy to work with, thus saving time, trouble and money.

You will always find "Renfrew" lime to be the same good quality—it has been the same for 25 years.

White Lime - Gray Lime
Stone - Drain Tile - Brick

Jamieson Lime Company
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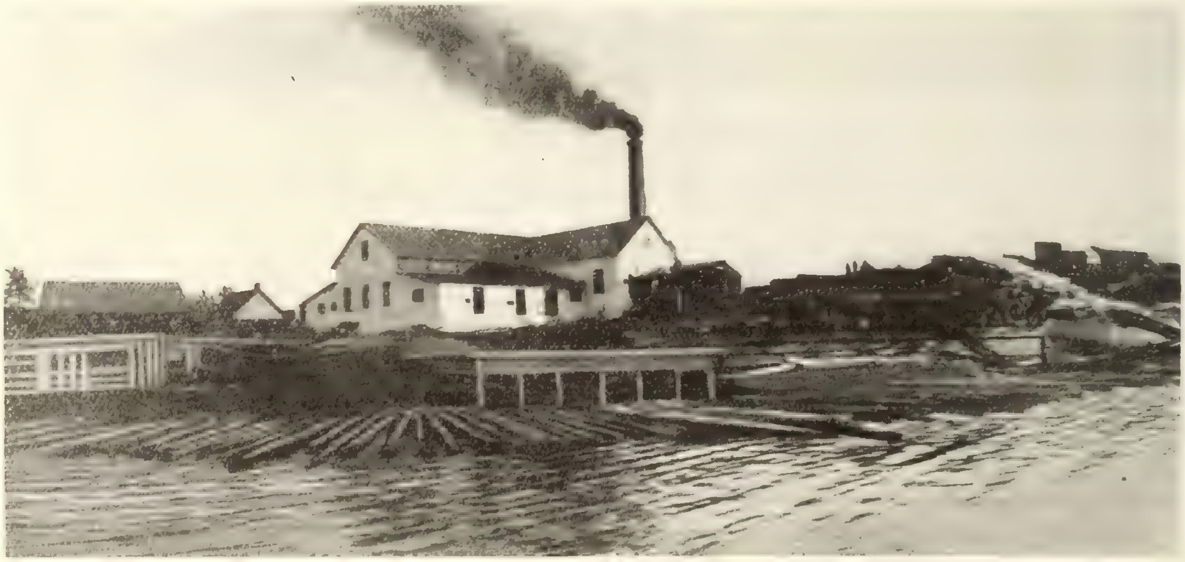

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OUR EXPERIENCE — OUR STOCK — OUR MILLS
AT YOUR SERVICE

Heavy Yellow Pine and Fir Timbers up to 80 ft. on hand

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We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Buildings and Structural Material.

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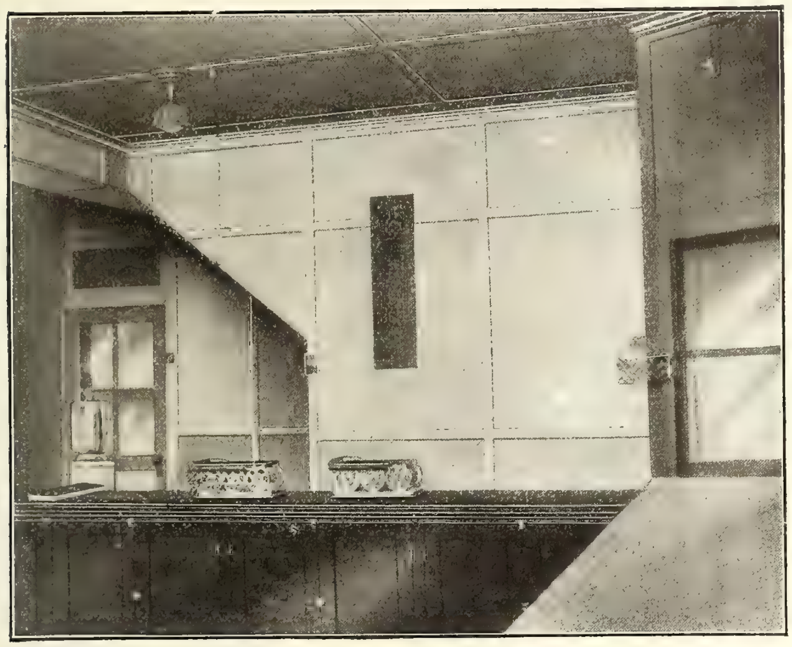

Fireproof Walls and Ceilings

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LINABESTOS
Building Board

Linabestos is made of Asbestos Fibre and Portland Cement, in stiff, solid sheets 3/16 inch thick, 42 inches wide, and either 48 or 96 inches long. It is pinkish-grey in color, can be readily cut with saw and chisel, and nailed directly to the studding.

Linabestos is usually panelled with strips of the same material, as shown in the illustration, or covered with a thin skim coat of plaster. It makes walls and ceilings that are not only fireproof but also warm in winter, cool in summer, easily decorated and practically everlasting.

Write for Folder No. 9, giving full particulars about this new and better Building Board.

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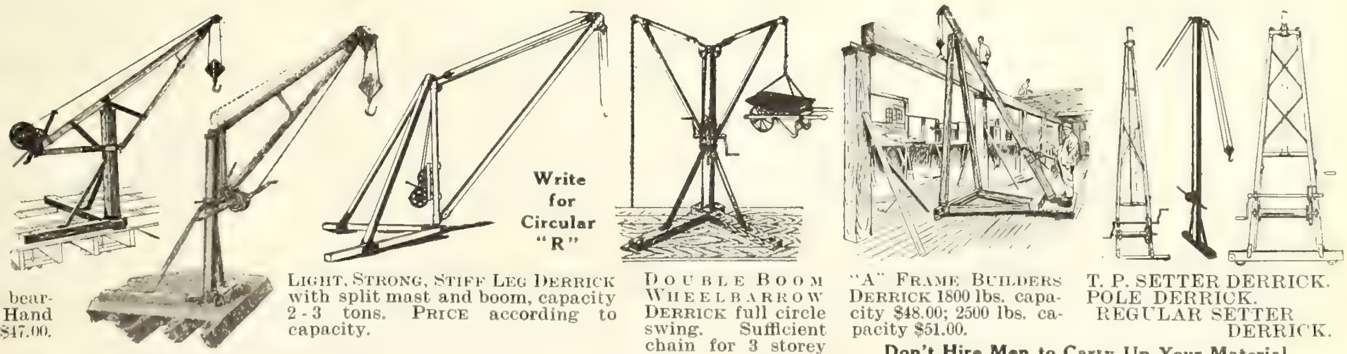
Address; E. T. Bank Bldg. 263 St. James St., Montreal Factory at Lachine, P. Q. (near Montreal)

The Most COMPLETE LINE OF BUILDERS' DERRICKS MADE



Reinforced Standard 2500 lbs. capacity with geared winch complete $48.00 or for Hand and Power $51.00.

PEERLESS STEEL DERRICK full circle swing, self-lubricating bearings, $45.00 Hand and Power $47.00.

LIGHT, STRONG, STIFF LEG DERRICK with split mast and boom, capacity 2-3 tons. PRICE according to capacity.

Write for Circular "R"

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"A" FRAME BUILDERS DERRICK 1800 lbs. capacity $48.00; 2500 lbs. capacity $51.00.

T. P. SETTER DERRICK.
POLE DERRICK.
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At these prices you can't afford to be without one of these derricks. THEY SAVE TIME, AND THAT MEANS MONEY. CONSULT US BEFORE PLACING YOUR ORDER. SATISFACTION AND PROMPT SHIPMENT GUARANTEED.

Don't Hire Men to Carry Up Your Material, Hoist It with a SASGEN DERRICK.

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SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

ALL OUR DOORS AND HARDWARE ARE LABELLED BY THE UNDERWRITERS.

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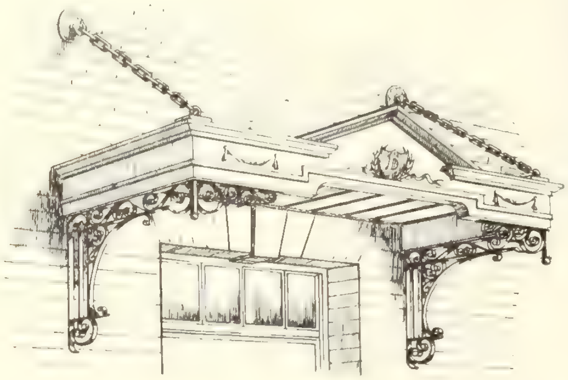

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SOLE producers of the Beautiful Royal Dominion marble quarried at South Stukely, Que. A card or 'phone call will bring our representative to submit figures on any class of marble work. Address all letters to the Company P.O. Box 1166, Montreal.

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saving their owners Time, Labor and Demurrage are illustrated in our latest Catalog. Write for one at once to

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Pioneer Manufacturer of

Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.

The benefit of 20 years experience as successful contractors.

Yours for the Asking

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Special Paints made **Specially** to meet **Special Conditions**

A Paint made to give the best possible results on ALL kinds of surfaces cannot (the fact is self evident) give the same protection that a paint ***made specially to protect ONE special surface*** will give.

SPECIAL PAINTS ARE OUR SPECIALTY

If You Contemplate the Painting of:

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TROLLEY POLES

We shall be glad to tell you of these Special Coatings
They will REDUCE YOUR MAINTENANCE COST

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Made in U. S. A. by DETROIT GRAPHITE CO., Detroit, Mich.

Carbonizing Coating Paint

The most durable and least expensive Paint made for preserving Iron or Steel in Bridges, Buildings, Structural Shapes, Gas Plants, etc.

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The only Paint that will adhere for years to Galvanized Iron roofing, siding, cornices, etc.

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The only Paint that will beautify and make walls, ceilings, tile, concrete, brick and stone walls moist-proof and sanitary. Produced with strong luster finish or semi-luster, or flat finish. Can be frequently washed without injury.

Manufactured in the United States and England by

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"Buffalo" **Punches Shears and Drills**

Among our recent designs is the Bar Cutter No. 10 for cutting concrete reinforced bars—twisted, round or any other shape. It cuts bars up to 1¼" thick and, due to its steel frame, its **weight is only half** that of a cast iron machine of the same capacity. Ask for catalog of Steel Punches, Shears and Drills No. 145.

Canadian Buffalo Forge Co.
MONTREAL Limited
St. John Winnipeg
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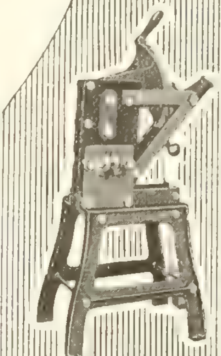
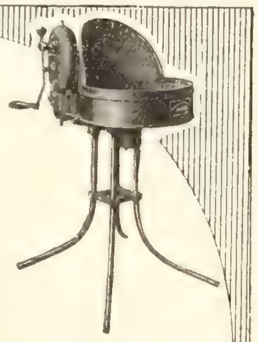


"Buffalo" **Forges**



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is the slogan of our **1912 Rivet Forge.** The repair cost by this design is guaranteed to be actually **cut in two,** compared with any other forge now in the market. A bridge company using a large number of forges writes us regarding it: "The operator claims it runs easier and heats more rivets in less time than any forge he has ever used." Let us send you one on free trial. Fifty other styles, for light and heavy work.

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Structural Water-proofing

"DEHYDRATINE"

For Water-proofing under the membranous method.

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For Water-proofing Concrete.

"FERRO FAX"

For Surface Hardening Concrete Floors.

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A Cement Coating—Makes Surfaces Water Shedding.

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"These Trade Names protect you against the possible selection of inferior materials. Whether you prefer a water-proof paint or a compound, we can give you satisfactory assurance as to the reliability of these products."

"FOR 15 YEARS STANDARD OF THEIR KIND."

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JACKS

For Every Lifting Purpose

"The Jacks that Duff Builds" are designed to give perfect satisfaction, and are noted for their durability, reliability, and easy, convenient operation.

Genuine BARRETT Track Jacks
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DUFF Ball-Bearing Screw Jacks
DUFF-BETHLEHEM Forged Steel Hydraulic Jacks

Capacities from 1,500 lbs. to 500 tons and a wide variety of styles and heights, insures the selection of the proper jack for any requirement.

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MONTREAL OTTAWA ST. JOHN TORONTO WINNIPEG
CALGARY SASKATOON VANCOUVER VICTORIA

3

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

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This picture shows

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This building was wired with
"Imperial Higrade" Rubber Insulated Wire

Architect; Pratt & Ross, Winnipeg.
Engineers; Neiler, Rich Co., Chicago.
Electrical Contractors; Schumacher Gray Co., Winnipeg.

Address enquiries to nearest office

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A Catalogue—

Every Builder and Contractor should have.

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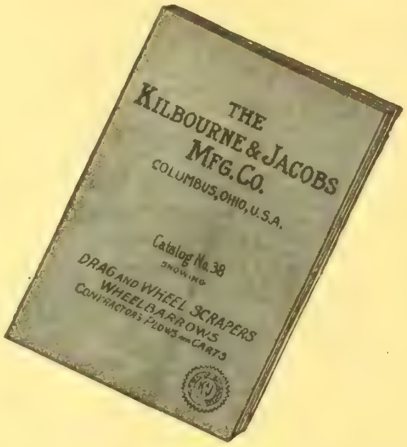
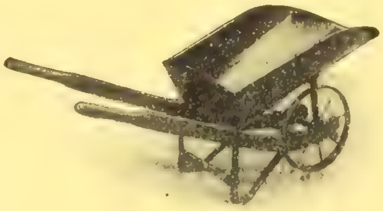


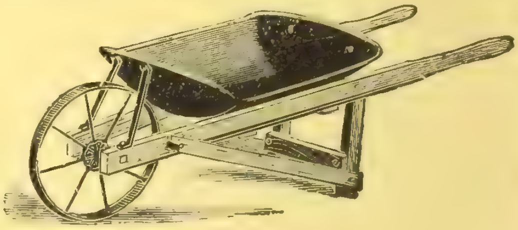
THE
KILBOURNE & JACOBS
MFG. CO.
COLUMBUS, OHIO, U.S.A.
Catalog No. 38
SHOWING
DRAG AND WHEEL SCRAPERS
WHEELBARROWS
CONTRACTORS' PLOWS AND CARTS

Have you received your copy of K. & J. Catalogue No. 38?

This New No. 38 Kilbourne & Jacobs' Catalogue illustrates and describes fully every style of barrow, wheel or drag scraper and plows. You may require equipment of this description—perhaps not at the moment but later on. This book will surely be of assistance to you as you can select the proper style of barrow, etc., for your requirements. Let us send you a copy—free for the asking.

"Kilbourne & Jacobs" Wheel Barrows





All styles in stock

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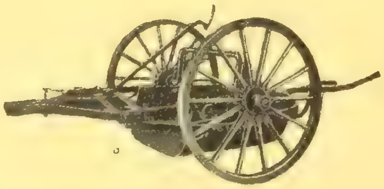

F. H. Hopkins & Co.

MONTREAL

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Vol. 27 Toronto, October 8, 1913 No. 41

ESTABLISHED 1886

Contract Record and Engineering Review

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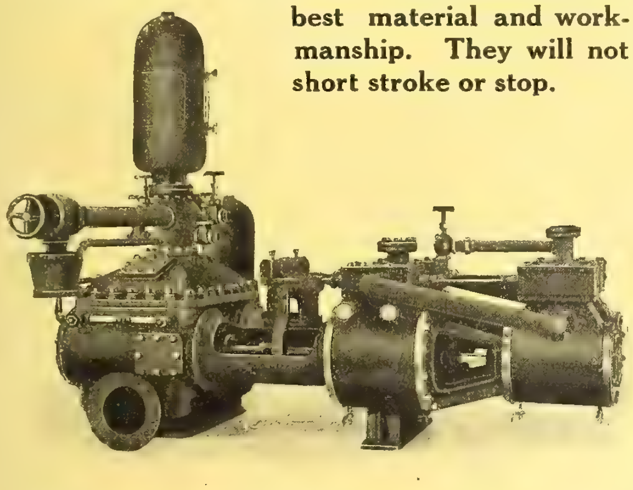

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Large Bent Plate Glass for Shop Fronts a Specialty

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OF BELLISS MAKE
have gained their reputation for

Simplicity of Design
Noiseless Running
Compact Design
Low Oil Consumption
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Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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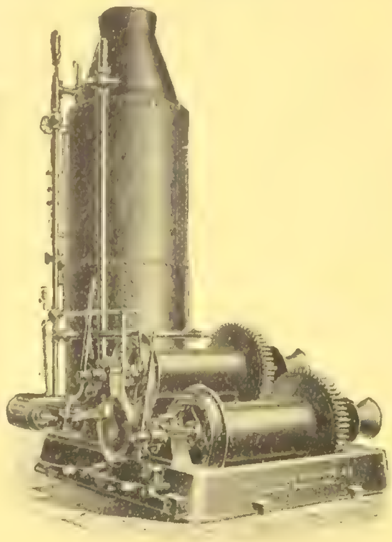
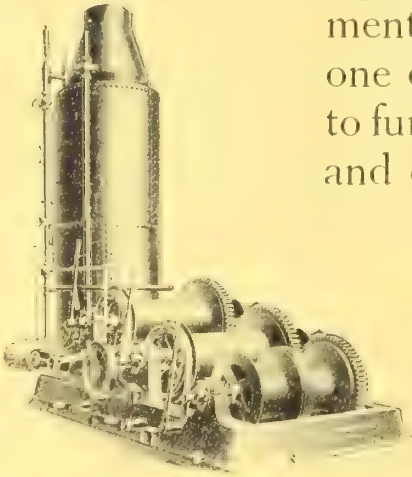
Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6



Hoisting Engines

With Single or Multiple Drums

¶ We build a wide range of these engines to meet every requirement of contracting work. Any one of our offices will be glad to furnish full particulars, prices and deliveries.



Each machine represents highest possible grade of material and workmanship.

The Jenckes Machine
Company, Limited

General Offices:—Sherbrooke, Que.
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IF YOU ARE A CONTRACTOR

Using Wire Rope

YOU NEED THE

GENUINE "CROSBY" CLIP

IT HOLDS

Drop forged steel—Galvanized, cannot break, slip nor rust. Has nine times the strength of cast clips.

Made By

American Hoist & Derrick Co.

St. Paul, Minn.

SOLD BY

Dominion Wire Rope Co , Limited.—Montreal, Can.
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CANADA Portland CEMENT

SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
PORTLAND
CANADA
CEMENT
MONTREAL

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

Canada Cement Company, Limited

Head Office - Montreal

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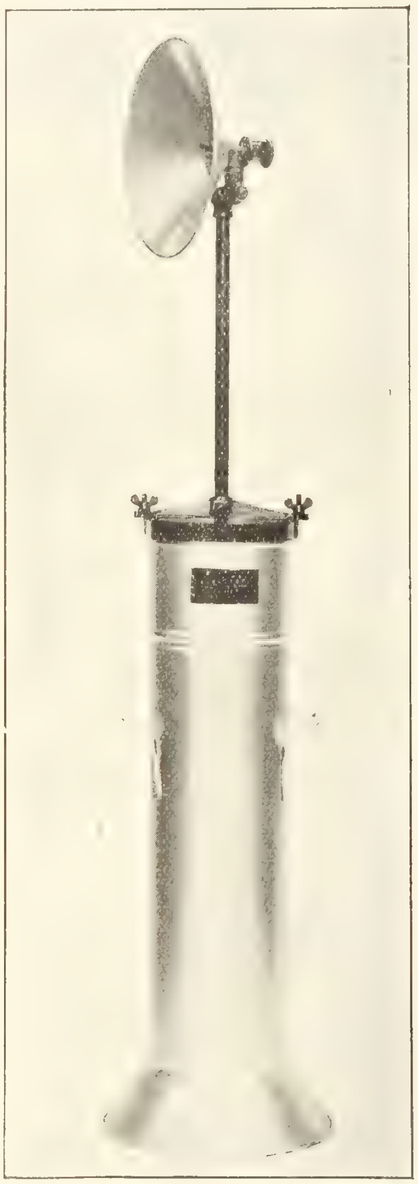
When You Can't Get Daylight



Get the Next Best.

The

Carbic Light

Gives a clear white light of 2,000 C. P.

Two sizes — Burning six and twelve hours without recharging.

The cheapest, simplest and most efficient light for contractors, railways, steam shovels, dredges, culvert and tunnel work.

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Is Standard and Up-To-Date.

Complete Outfits—Including, Dress, Helmet, Air Pump, Tubing, Hose, Weights, Shoes, Mittens, Etc., always carried in stock.

Morse Outfits are unrivalled for safety, simplicity, efficiency and durability.

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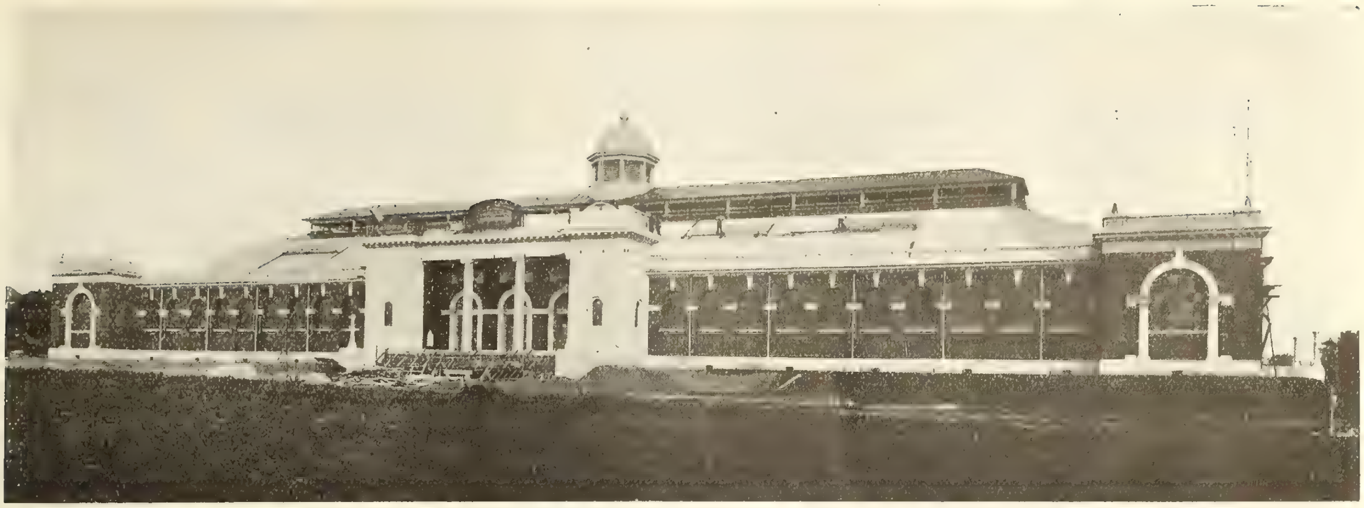


TRANSPORTATION BUILDING, CANADIAN NATIONAL EXPOSITION, TORONTO.

Built of

Don Valley Bricks

THE building pictured above is admired by a million people annually and it is constructed of Don Valley Bricks.

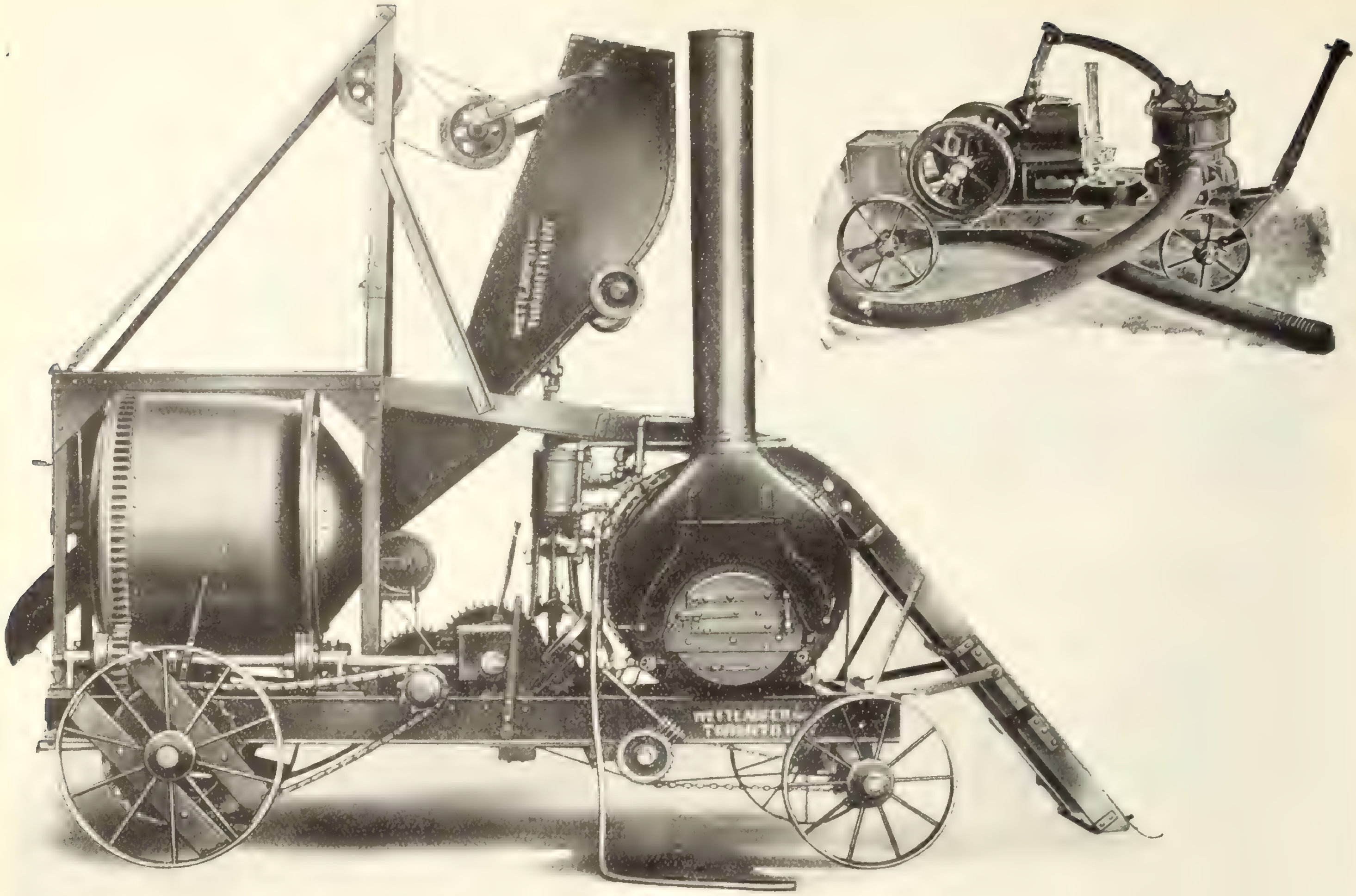
This material was selected for its proven ability to withstand the destructing influence of time and erosion.

In every part of Canada may be found buildings of Don Valley Brick and Terra Cotta Fireproofing.

Specify Don Valley.

Don Valley Brick Works

Toronto, Ontario



Thorough

and

Economical

in

Operation

Wettlaufer Concrete and Contractors' Machinery

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont., Buffalo, N. Y., Detroit, Mich.

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Cement
and
Crushed Stone

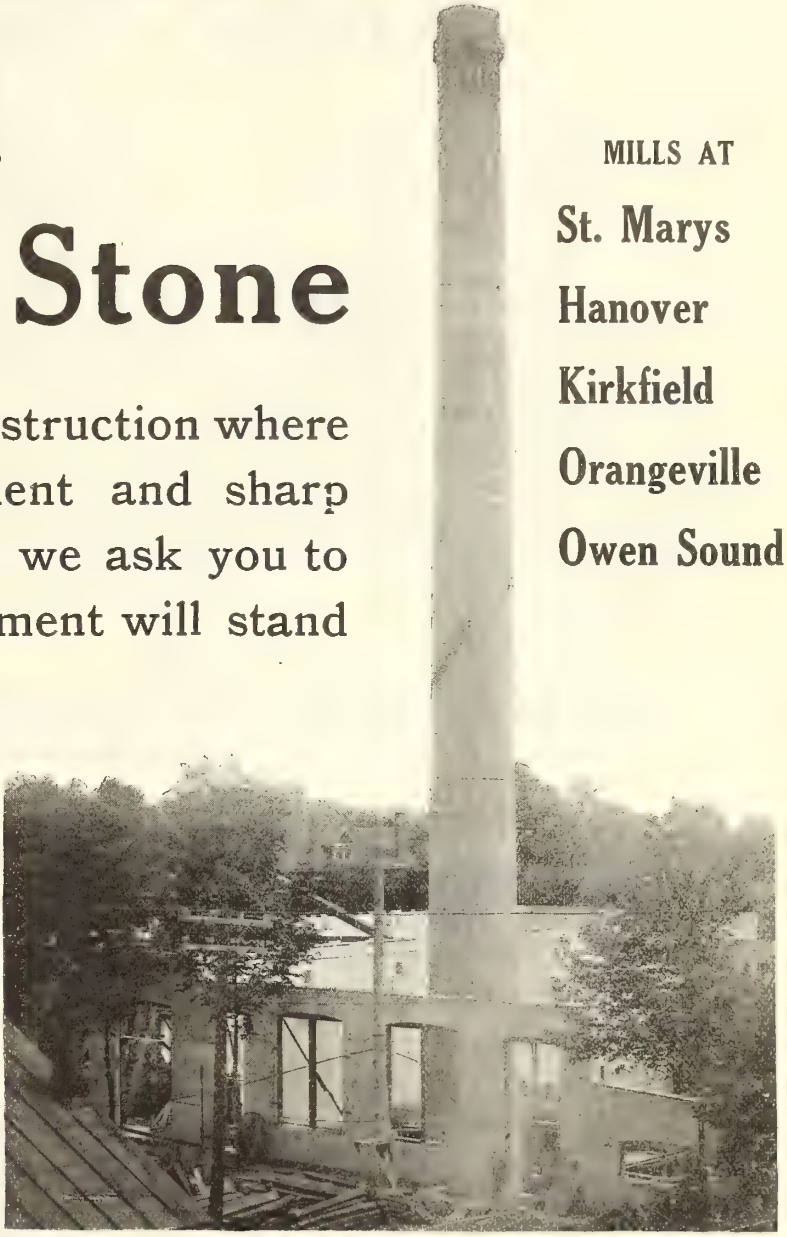
For difficult concrete construction where the highest quality cement and sharp clean stone are required we ask you to specify Rogers'. Our cement will stand all your tests.

MILLS AT

St. Marys
Hanover
Kirkfield
Orangeville
Owen Sound

125' x 5' reinforced concrete chimney. Built for the Dominion Canners Co., Limited, by The Weber Chimney Co., Chicago.

Rogers' Cement used.



Alfred Rogers
Limited

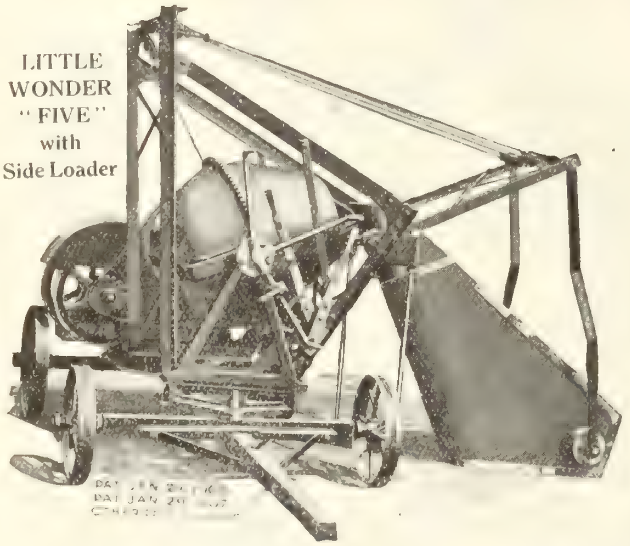
28 King Street West
Toronto

QUARRIES AT

Vinemount
Dundas

"The Mixers that Make the Money"

LITTLE WONDER "FIVE" with Side Loader



The WONDER Line

The LITTLE WONDER "FIVE" revolutionized small concrete work by its speed, easy portability and many other advantages.

THE WONDER "TEN" embodies the same principles on large scale and caused equal sensation, for it does the work of the largest mixers with only 30 to 50 per cent. of their initial cost.

We will show you that here is something you must have to place yourself in line with contractors who are making big money. We will prove to you, by their own words, that thousands of men have largely increased their profits with these machines. Further—we give you TEN DAYS' FREE TRIAL of a WONDER mixer on your own work, to prove our claims without cost or obligation to you.

And we Prove it to You

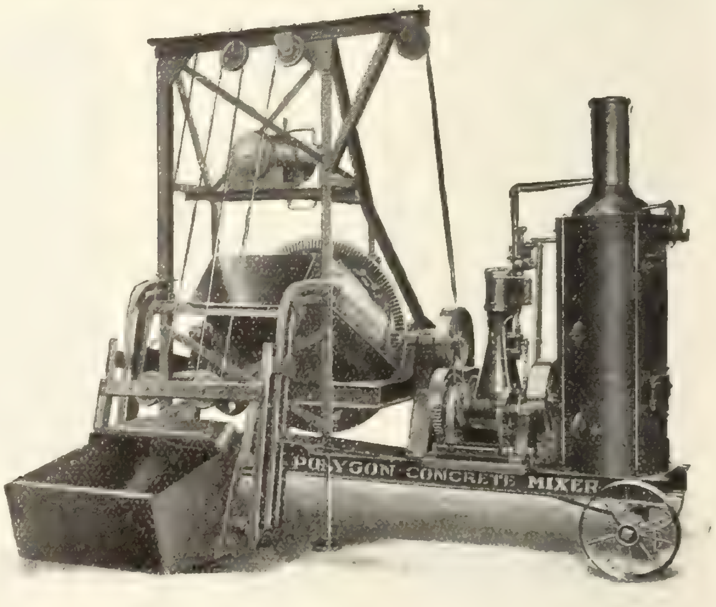
The POLYGON Line

The POLYGON steam outfit shown here is a popular type of mixer for use on large irrigation projects, railroad construction, municipal work, etc. The POLYGON drum, previously explained, is guaranty of completeness and rapidity of mix, for which its reputation is world wide.

The POLYGON is thoroughly standardized. It is adjustable throughout to wear and alignment. Its strength, durability and adaptability under trying conditions have proved its excellence.

Our concrete mixers of various types are the logical choice of those who investigate. There is no escape from conviction, in any impartial mind, of the scientific principles upon which they are built. In earning capacity they surpass all others.

If you are looking for these things, get in touch with



WATERLOO CEMENT MACH'Y CORP'N

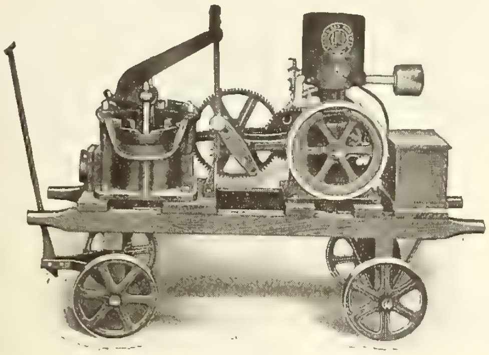
117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists, Elevators and Cement Tools

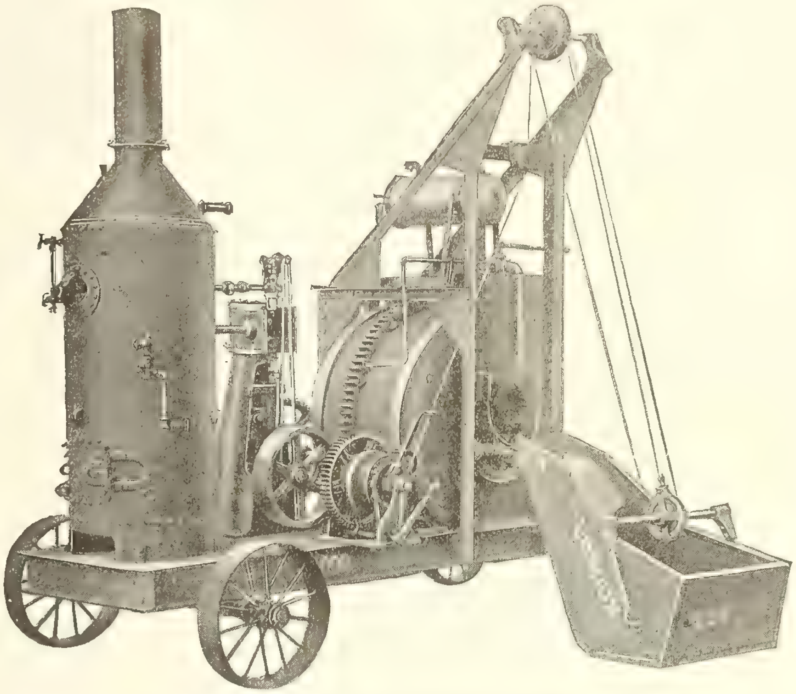
CANADIAN REPRESENTATIVES:—Waterloo Cement Mach'y Corp'n, 127 Coristine Building, Montreal, Que.; General Mach'y Co., 22 Mulock Ave., Toronto, Ont.; J. W. Anderson, 3 Bank St. Chambers, Ottawa, Ont.; J. A. McTaggart & Co., Winnipeg, Man.; Strumbert, Virtue & Co., 319 Pender St., Vancouver, B.C.

Before You Buy Concrete Machinery

or Equipment of any kind, write us for our 180 page catalogue.



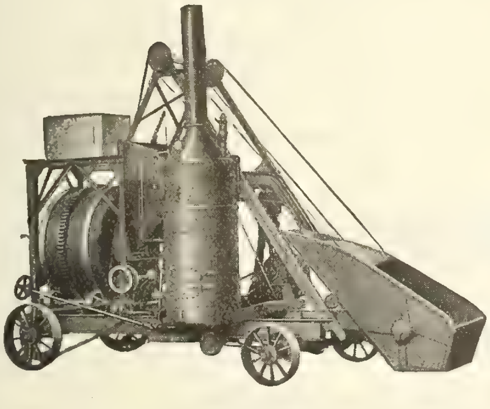
Power Diaphram Pump



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

We are the largest manufacturers of Concrete Machinery in Canada.



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

We do not build machinery down to a price but up to a standard.

London Sill Step and Window Cap Mould

A few lines we manufacture—

Concrete Mixers, Mortar Mixers, Tile Moulds, Drain Tile Machines, Side Walk Tile Machines Cement Block Machines, Cement Brick Machines, Sill Step and Window Cap Moulds, Gasoline Engines, Screens and Elevators Fence Post Moulds, Hoisting Engines, Material Elevators, Concrete Carts, Wheelbarrows, Scrapers, Sidewalk Forms, Pumping Outfits

A complete line of Contractors' Tools.

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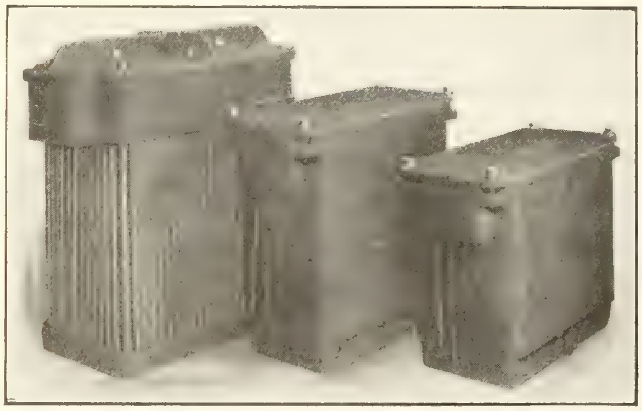
Reduced Loss
Increased Profit

Ferranti
Transformers



Three Phase Pole or Station Transformers

The Transmission line that is equipped with Ferranti three phase transformers is always a profitable one because of the great reduction in energy-loss made possible by these efficient transformers.

All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

Three phase transformers are the most economical type to operate and will effect a considerable saving in construction cost.

Write us for particulars

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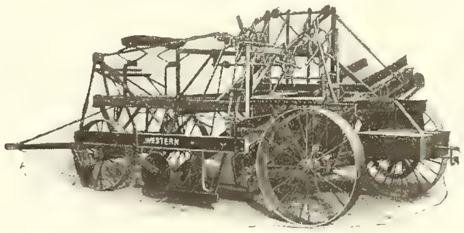

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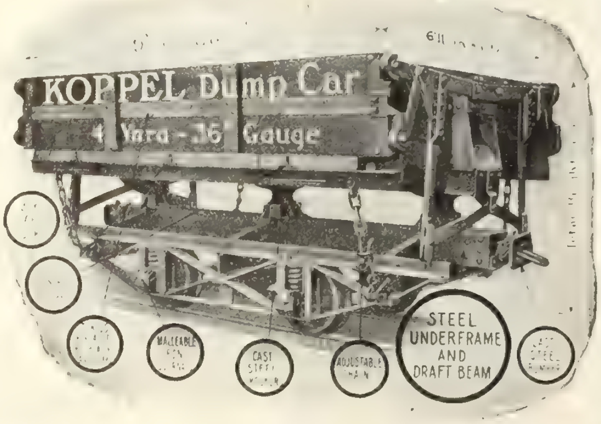

Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

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Orenstein-Arthur Koppel Co.

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3d. Of great durability.

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2d. They cost ***nothing*** to maintain, and
3d. They usually last, without repairs or leaks, ***20 years*** or over.

The net result of these three factors is a unit cost of about 1/4c. per foot per year of service. This is a lower unit cost than ever attained by any other class of roofing.

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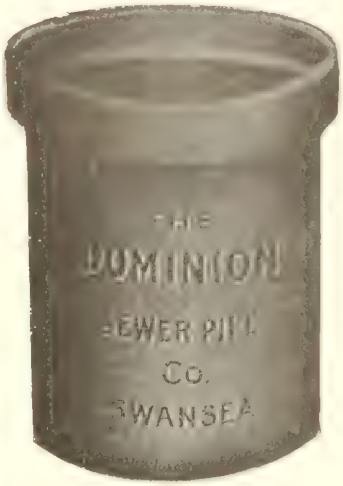

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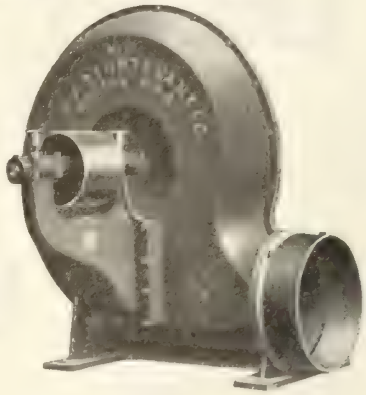

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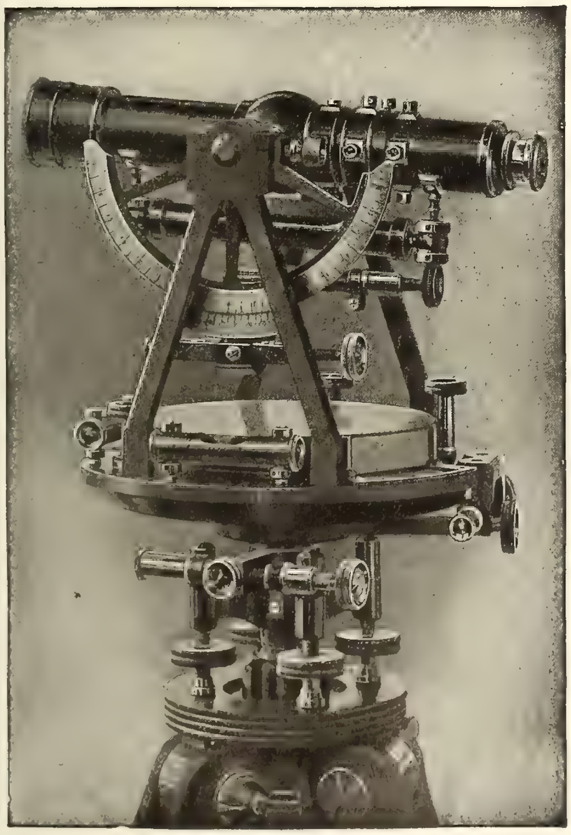

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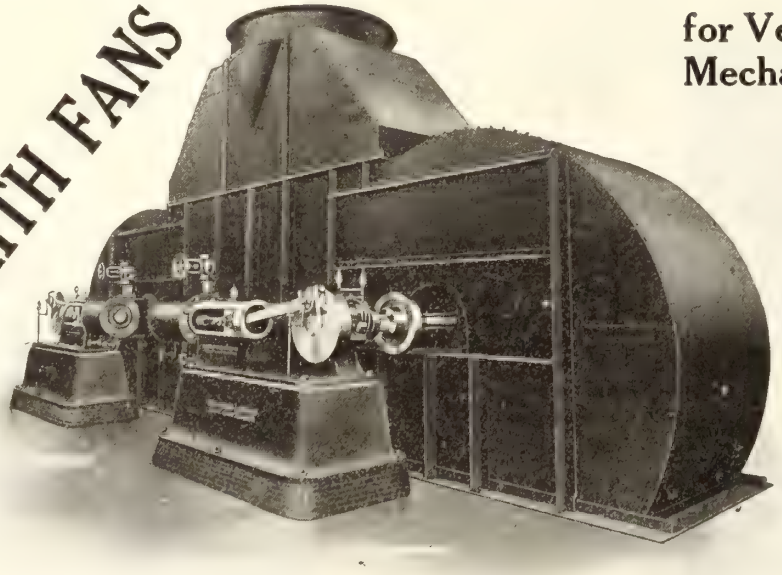

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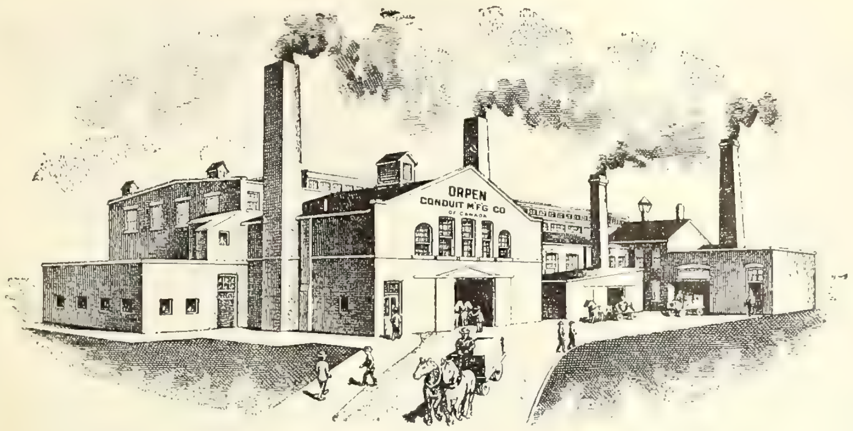

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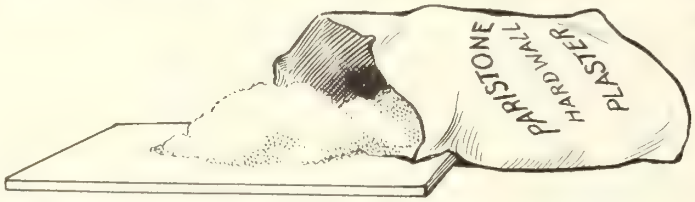

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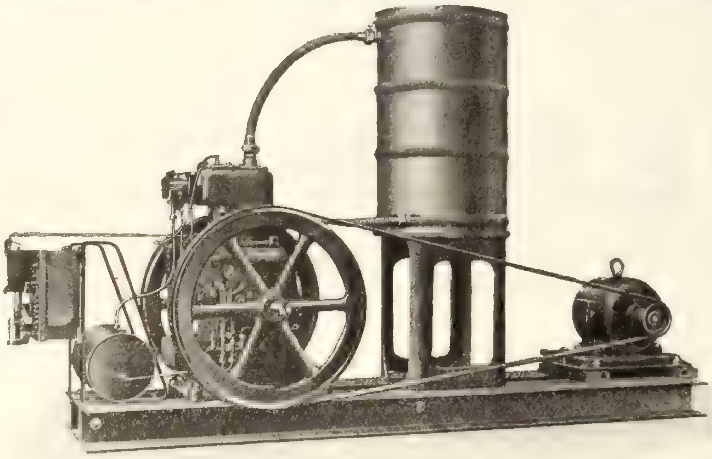

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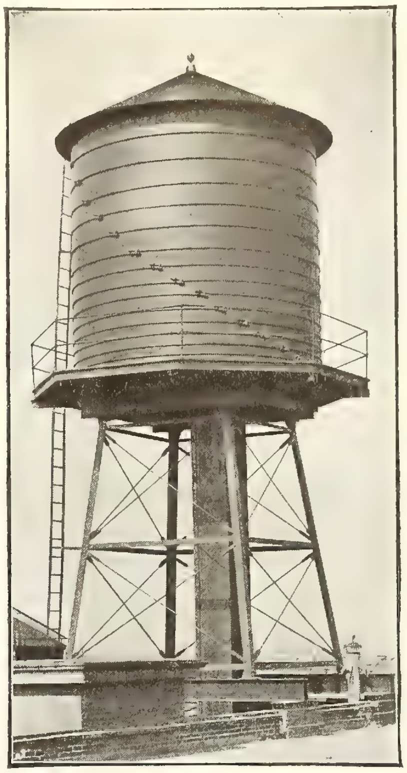

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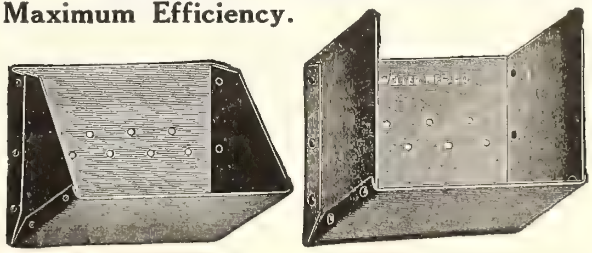

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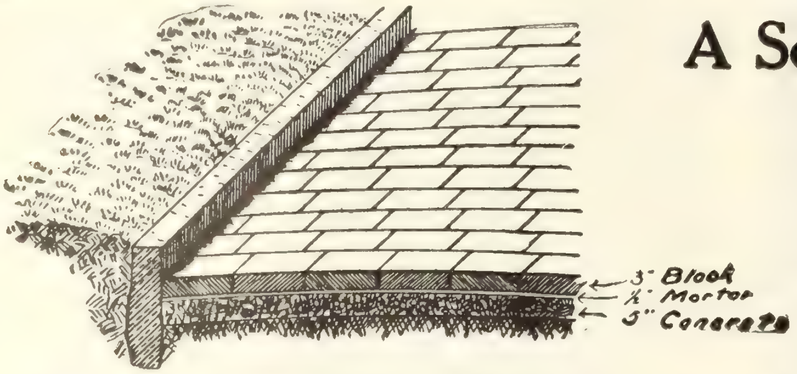

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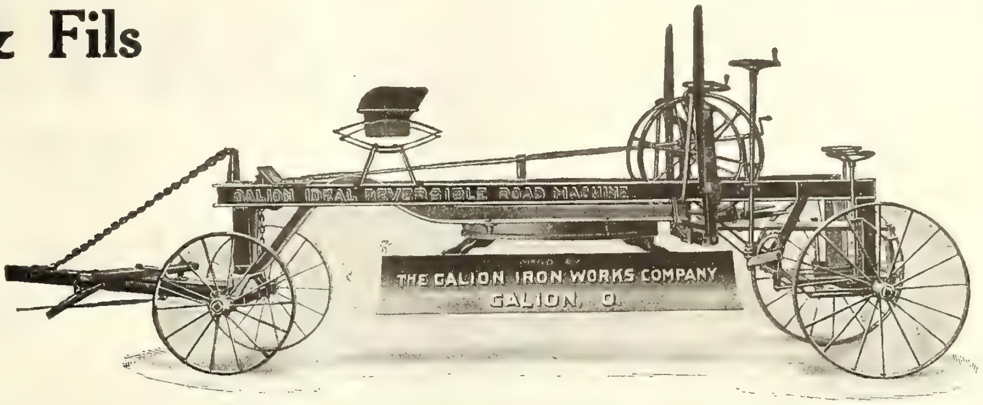
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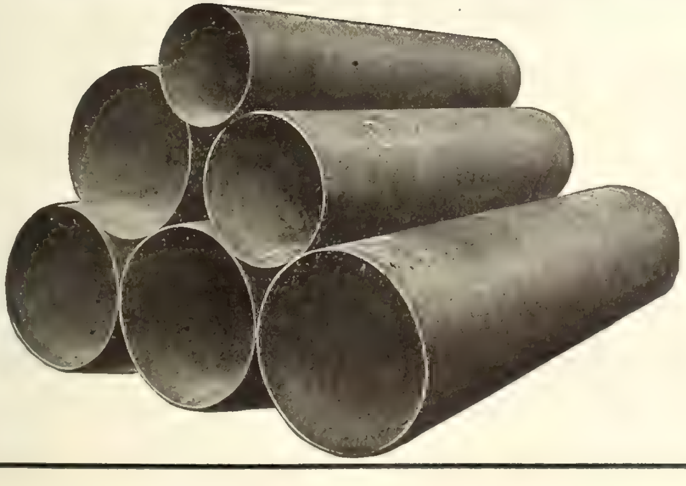

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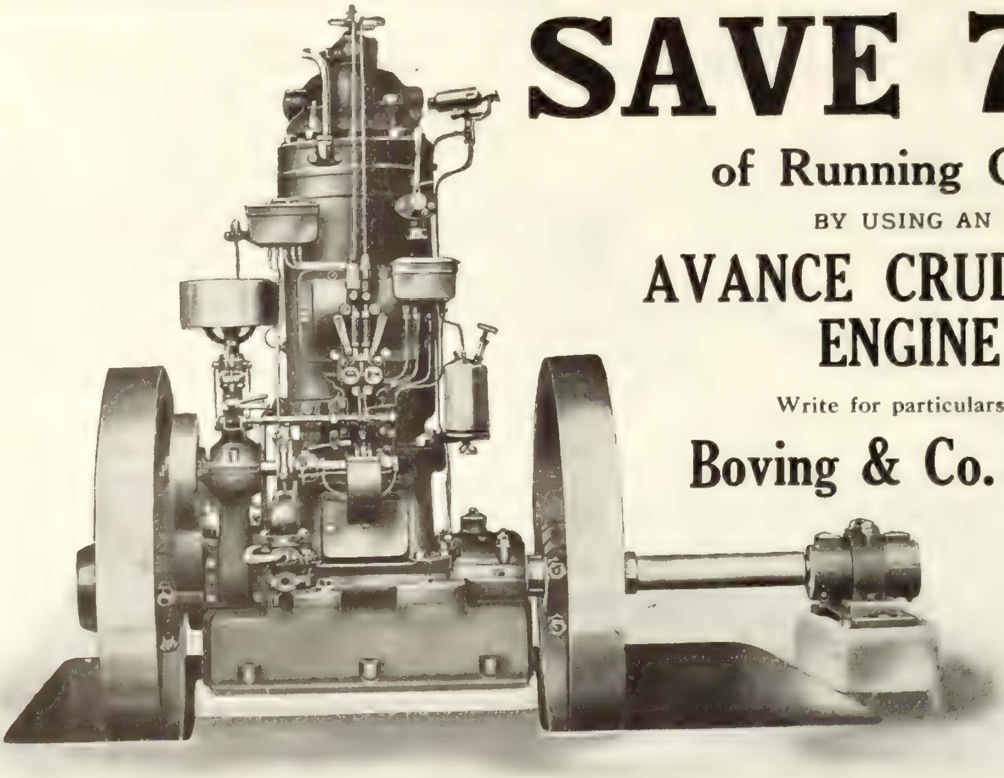

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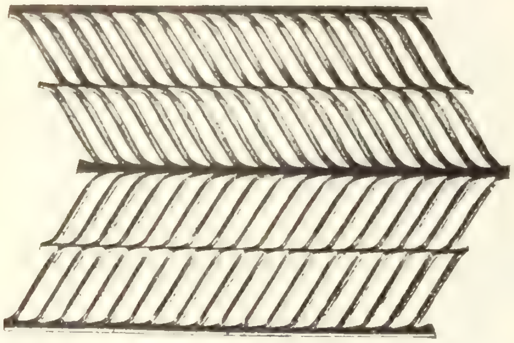

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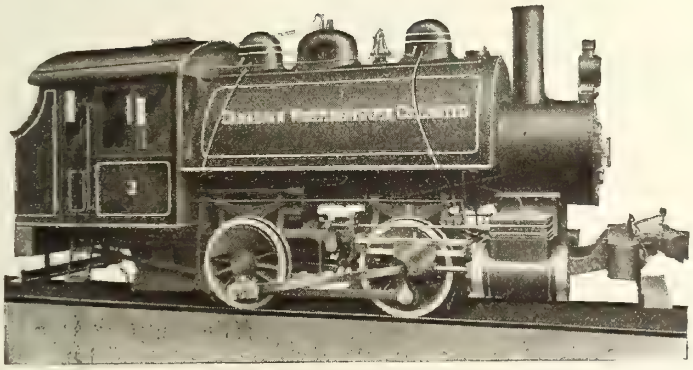

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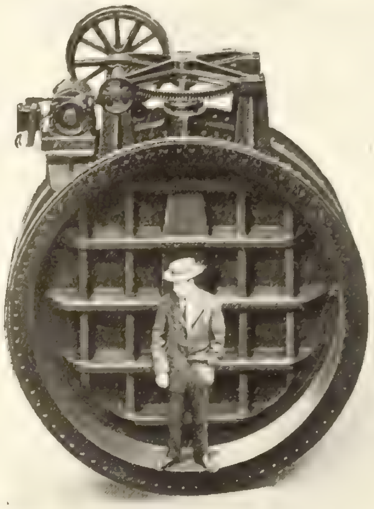

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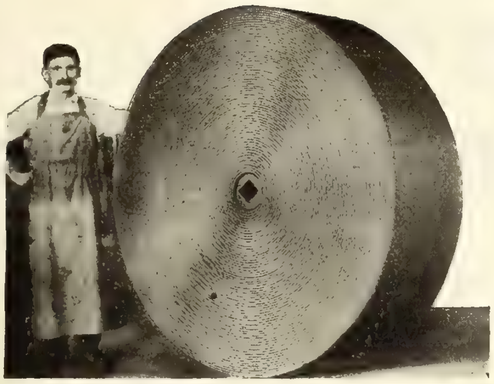
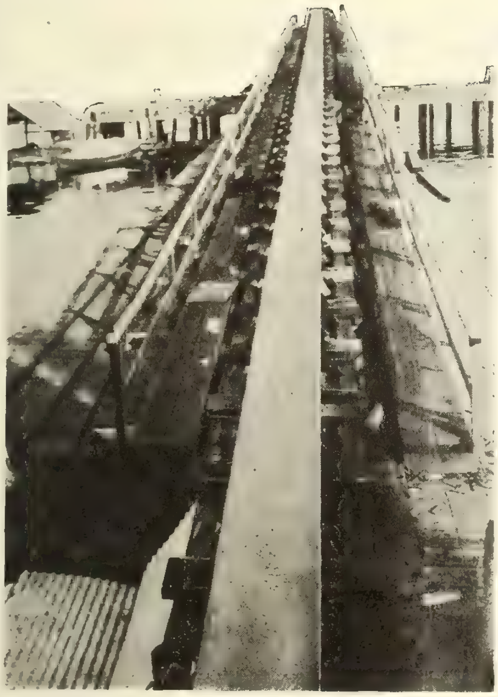


Goodyear Conveyor Belt for the Rainy River Gravel Co., Vancouver. Made in one piece—seven hundred and fifty feet long.



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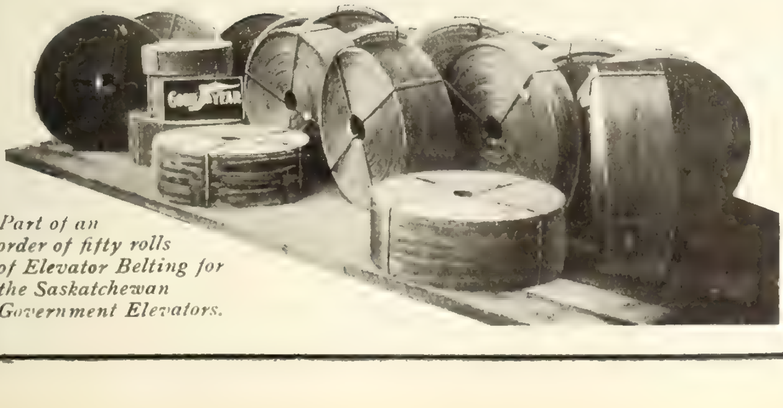

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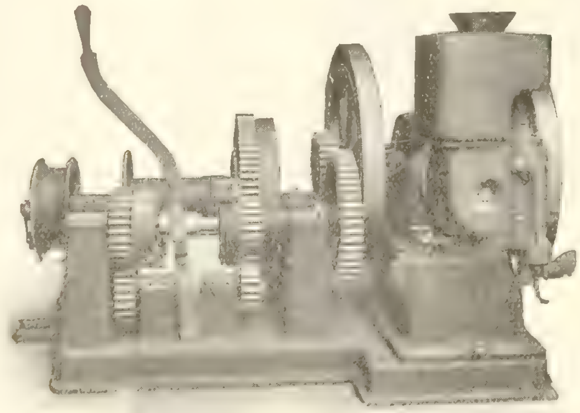

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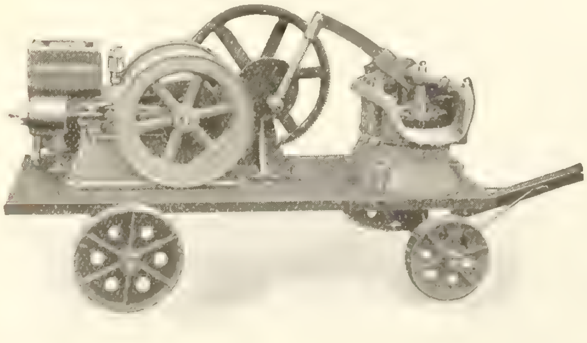

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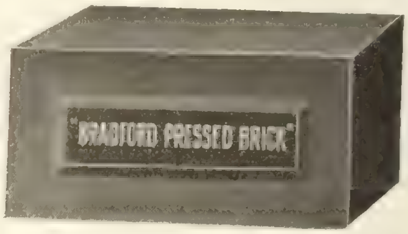

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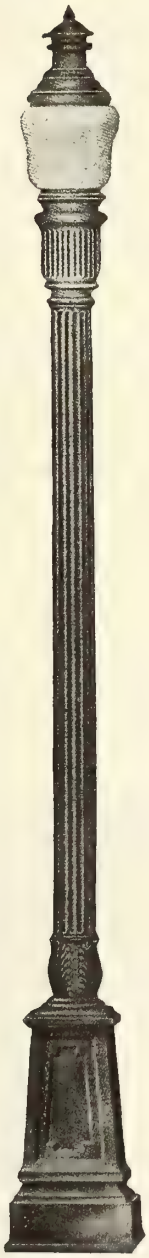

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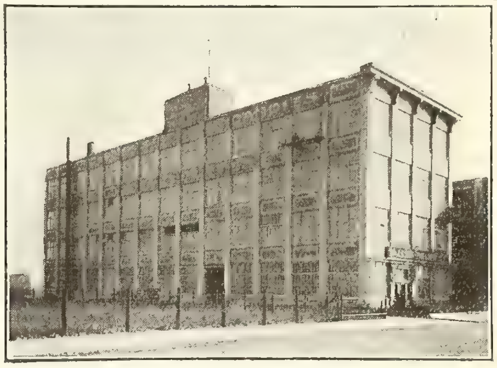

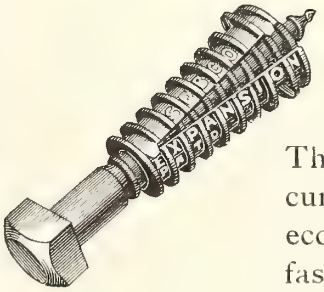

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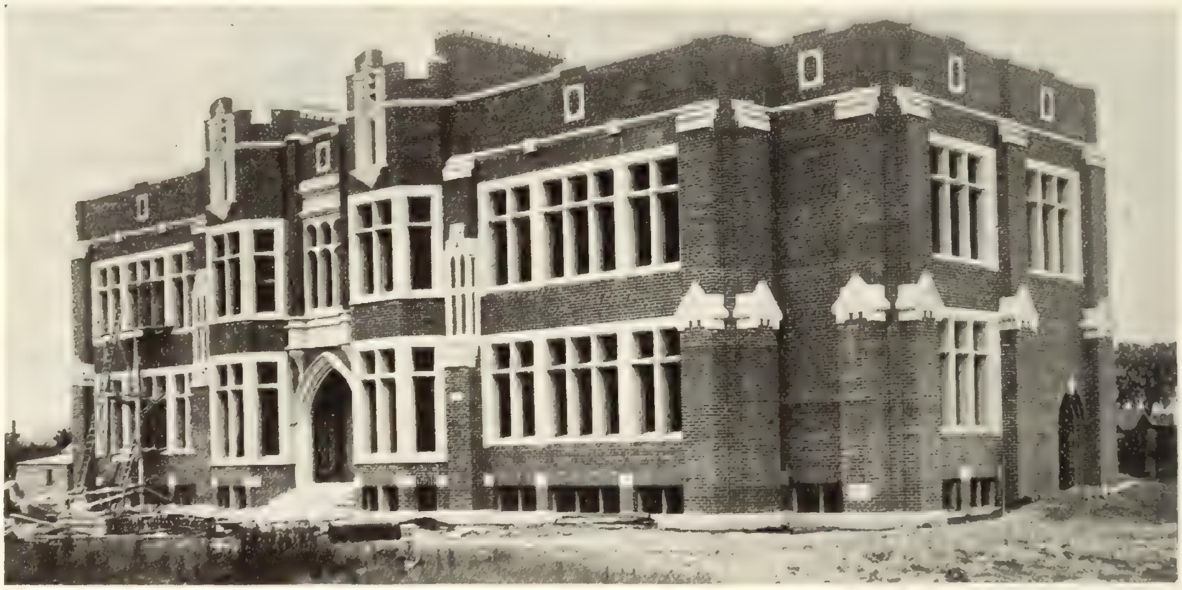

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The Status of the Engineer

THE part of the engineer in the public health movement was outlined in an interesting paper submitted recently to the Canadian Public Health Association by Mr. J. Antonisen, Superintendent of the Brandon Street Railway. While giving due credit to the medical men for their achievements, Mr. Antonisen showed that the civil engineer had it in his power to make or mar the whole question of public health.

It is the engineers who are the real doctors of the community. Their responsibilities in connection with water supply, sewerage and the disposal of refuse are paramount. Mr. Antonisen's paper constituted a plea for the better recognition of the municipal engineer and for his more adequate remuneration.

We are reminded of the procedure in appointing an engineer in the average town and city, particularly in the west. When a vacancy occurs, a number of candidates are obtained, either by advertisement or application, and finally an appointment is made—at a bare living salary—and the fortunate candidate is expected to have—or to assume—an expert knowledge of all branches of civil engineering and to shoulder cheerfully the responsibilities of public health and safety. Also he must show an all-round knowledge of design and construction or fall into disrepute. He must be able to converse freely about waterworks and sewerage systems, sidewalks and streets, bridges, sewage disposal plants, refuse destructors, reservoirs, water towers, and all the rest of the olla podrida of municipal construction.

As long as the town is small, it is content to pump the water from a river or lake, using it without any kind of treatment. It is considered all right to discharge raw sewage into the creek, or river, or lake, as long as the waterworks intake pipe is up-stream and the sewer outlet down-stream—or in the case of a lake supply, a couple of miles apart. But when the death rate rises up to uncomfortable figures, then the first question asked is: have we got a pure water supply? The overworked busy city engineer has worried over this question in idle moments, between midnight and sunrise generally, and has perhaps formed an opinion of what steps should be taken to safeguard against contaminating an existing pure supply or procure a better supply than one already contaminated.

The larger problems of municipal engineering life are outside the pale of the duties of the city engineer and the council should be brought to see the wisdom of employing a consulting engineer. The average city engineer cannot be regarded as an expert in the true sense of the word. The very demands of his position make him a jack-of-all-trades. Municipal engineers are ill-advised to tamper with such problems as the treatment of sewage. To treat sewage in such a way as to render it harmless is one of the greatest engineering problems of the day and a plant designed upon wrong principles is worse than none at all.

A point which received special emphasis at the hands of Mr. Antonisen was the importance of the subject of city planning in the education of the municipal engineer. Last year the city of Moose Jaw sent Mr. Antonisen, then city engineer, as a delegate to the Winnipeg city planning convention and he was practically the only official of his kind in attendance. Certainly this branch of engineering should receive careful consideration in a country which is developing so rapidly as Canada, and whose rapid development in itself affords a field for expert specialization. Generally the town engineer has to pass all the sub-division plans and in a few years his mistakes may be difficult to rectify except at enormous cost.

The tenor of the whole is co-operation. If city councils, health authorities and others were to substitute a measure of co-operation for much of their criticism, far greater efficiency would be obtained from our engineers. And the co-operation should extend into the financial side. Less grudging assent should be given to the employment of consultants on special work. There is enough work of a purely executive character for the engineer in the rising Canadian municipality, without saddling him with responsibilities which are altogether disproportionate to the salary he is earning.

Good Roads to the Fore

The Ontario Provincial Highway Department is prepared to keep the educational value of their work before the public. A movement has been started to utilize the assemblies of people at the annual fall fairs of the province, to show what is being done to their highways, the demands of individual constituencies and the more scientific methods of coping with them. This new venture was tried out first by means of an exhibit at the Windsor Exhibition just closed. Here an unusually large and instructive display of model roadways was prepared under the authority of the government and set up for the public enlightenment. The idea contained did not refer to the planning of the new highways commission, but served as a demonstration of the county system now under way.

Principles versus Practice in the Teaching of Engineering

THE increasing influence of the specialist in modern professional life is being felt in institutions of higher engineering education to a degree which warrants a note of warning against a possible neglect of fundamental principles in the intense pursuit of current practice which is found in so many classrooms as the natural result of employing the so-called laboratory method in up-to-date instruction. Interest in concrete problems and apparatus naturally is felt by the student of engineering. The majority of undergraduates prefer to be taken through a large plant on an inspection trip or to be allowed to perform minor tasks in connection with some test or construction work of commercial value than to "bone down" to principles and mathematics bearing upon the theoretical side of present-day practice. Abstract problems appeal only to the minority in every walk of life. Just as the present civilization cannot be correctly interpreted without a reasonable knowledge of the past, so must the most enduring progress in the engineering profession rise from the great fundamental principles which are virtually fixed in comparison with the ephemeral practice of the moment. Little danger exists that practice will be ignored in schools responsive to the spirit of the laboratory, but there is some doubt whether the fascination of studying the latest vogue in different engineering specialties may not at times obscure to both teachers and students the profound importance of fundamentals.

Experimentation without thorough grounding in principles may uncover valuable finds now and then, but it will not further the most efficient work. The limitations of current practice are very much greater than most people realize, and many a young engineer has learned this to his sorrow when he has tried to meet new conditions with handbook formulae of restricted scope. It has often happened that results of enduring value have come about through the work of so-called theorists upon empirical data and designs which alone have failed to solve the problem in hand—and which probably never would have solved it without the help of the expert in principles. This point was illustrated by Dr. James Douglas in his commencement address last spring before the Colorado School of Mines, upon the "Larger Importance of Principles than Practice in Technical Education." He showed that the effect of the injection of air into molten metal was perfectly understood before Bessemer brought mechanical ingenuity as well as chemical science to bear upon the solution of the pneumatic method. The practicability of extracting the carbon to the exact point at which pig iron is converted into steel proved to be so difficult that the Bessemer process would probably have had a limited range of usefulness had not the suggestion of another chemist been adopted—to oxidize all the carbon, then readd to the charge the specific amount of carbon to recarbonize the iron, while the manganese absorbed any dissolved oxide of iron. The whole success of this momentous improvement, which was no discovery at all, depended upon the application of known facts to meet certain practical conditions.

Insufficient knowledge of principles spells disaster for the engineer who attempts to rely upon current practice alone in contributing to the real advancement of the industry. In the electrical field, new methods and applications are coming so rapidly into use that the practitioner without a deep-rooted understanding of the laws which underly it finds himself hard put to keep in sight of the "tail-end" of progress; he loses time in grasping the significance of specific developments and undertakes original and responsible work at no small risk to his reputation. Without a knowledge of stresses and strains, he designs a steel tower transmission line at his peril; without keen comprehension of the phenomena of inductance he locates and spaces conductors with the chance that the resulting voltage drop will be perhaps 30 per cent. greater than is warranted; and without an understanding of all the complex electrical considerations influencing the power-factor and the load-factor, he copies his neighbor's practice at the risk of financial ruin. All the construction drawings of concrete reinforcement that can be crammed into a single desk after being brought home from other jobs are of little value if the designer confronted with a new set of conditions is weak on figuring his own stresses. In the field of power-plant design the engineering executive whose word is final in the selection of machinery may not be familiar with all the latest practical appliances for corralling the elusive heat unit between the furnace and the feed-water heater, but he must possess a knowledge of the fundamental laws of steam engineering.

This side of the subject of professional education is apt to be overlooked by the young fellow whose enthusiasm is rightly stimulated by frequent observation of the triumphs of the men in the field, but he will realize it soon enough if he associates with less well-grounded workers after graduation. It is surprising how flexibly one can meet new demands year after year, given sound and extensive preliminary training in main principles, supplemented by constant hard work in their varied application. There is no need to discuss here the relative benefits of class-room and laboratory instruction or the comparative value of machine design and machine testing; for all these phases of education have their place in a well-planned curriculum. But in the last analysis, manual skill belongs to the artisan rather than to the engineer, and a knowledge of principles is of more value to the latter than familiarity with engineering equipment. Even the engineer's acceptance of principles, outside of mathematics, should be held as open to modification, but in the main the fundamental laws of physics and chemistry should be appreciated in all their inclusiveness as the primary working tools of the profession, and as such should receive the first consideration of instructors, whose lives are largely devoted to sending properly qualified recruits into the ranks of modern industry.—Engineering Record.

Temporary wing dams made of refuse piling and cheap lumber will be constructed to check the erosion taking place on the shore of Limon Bay, immediately to the west of the west channel of the Panama Canal.

A considerable section of the shore at this point, according to the "Canal Record," has been worn away, and erosion will probably continue unless preventive measures are taken. As it is not definitely known whether the adopted method will check the wave action sufficiently to warrant the construction of permanent dams, these temporary structures, expected to hold together for at least a year, will now be erected at a cost of about $2,000. During that period opportunity will be afforded for studying their effect on the shore line, to determine whether permanent structures will be suited.

Suggestions for City Engineers

SUGGESTIONS for the development of a typical city with regard to buildings, sewers, waterworks, pavements and electrical distribution formed the basis of a paper by Col. H. N. Ruttan, city engineer of Winnipeg, presented before the recent meeting of the League of American Municipalities. The following notes embody some of Colonel Ruttan's recommendations:

Limits for building should be fixed within which only fireproof materials should be used. As the difference in cost between fireproof material and wood is rapidly lessening, the fireproof limits should be ample, including, in addition to business areas, all first and second-class residence districts. All schoolhouses should be fireproof and long, crowded lines of wooden residences should not be tolerated.

Inasmuch as present facilities for passenger traffic have eliminated the necessity for extremely congested centers and high buildings, laws should be enacted to limit the height of buildings and the distances from the street lines. A simple method is to determine the vertical angle at the center of the street beyond which no structure shall project. In residence districts this angle should be sufficiently flat to prevent injury to ordinary dwellings by the erection of massive apartments or tenements.

In computing sewer sizes for growing cities full allowance should be made for an extended paved area, as it is much better that the sewers prove too large than too small. Manholes on pipe sewers should seldom be more than 250 ft. apart. On large sewers which can be traversed by men this distance may be increased to 400 or 500 ft.

Flush tanks should be placed at the heads or dead ends of all sewer branches. An automatic type which has quick-flushing capacity and which can be readily turned on and off is recommended in order that the intensity of the flushing may be regulated to suit the requirement of different parts of the sewer system.

Connecting Y branches on both sides of the sewer at intervals of 25 ft. in congested districts will be found to offer all necessary facilities without the necessity of installing new junctions.

A universal meter system is the only sure and economical means of waste prevention. In order to insure the use of sufficient water for sanitary purposes, a flat rate should be charged the consumers for what is determined upon as a sufficient quantity for each size of house, and the meters used to determine excess, which should be charged for at a substantially higher figure than the flat rate.

Business and residence districts differ in requirements for pavements. Business streets should be paved full width between the sidewalks and should be capable of carrying loads of 5 tons per wheel. On residence streets full traffic facilities will be afforded by pavements 24 ft. in width, capable of carrying 5 tons on a four-wheeled truck, or a 10-ton road roller. Pavements can be so arranged that under growing traffic they may be readily widened and increased in thickness without harm. Where it is necessary to haul heavy loads through residence districts a heavy traffic road can generally be arranged so that the heavy traffic can be kept off the light roadways. On residence streets the most pleasing arrangement of street improvement is that where the pavement in the center is flanked by two broad grass plots, with the sidewalks on the property lines.

The curbs on street-crossing corners should have radii of at least 15 ft. Broad curves are more pleasing and offer much less obstruction to vehicular traffic than sharp corners.

At sidewalk crossings the pavements should be kept near the walk level; 6 in. or less should be the maximum height of steps. This necessitates the placing of the sewer catch-basins in the center of the blocks, not at the intersections.

The system under which the grass and trees on the streets are kept in order by a public department is much to be preferred to any plan which involves the property owners as caretakers.

To avoid crowding and danger it is suggested that in business districts an additional sidewalk at the level of the first story of the buildings be constructed. The protection of the lower sidewalk from sun and weather, the added value for business purposes of the floor at the level of the new walk, and the enhancement of the uniformity and beauty of the streets are also suggested as advantages.

Communication between the two decks would be by stairways or elevators at convenient points and through the business premises fronting on them. Access to buildings at different levels would be by steps or inclines. Protected by a substantial railing on the street side, the upper deck would be an ideal promenade.

While underground electrical distribution is desirable, care should be taken not to extend conduit system beyond points where the revenue is sufficient to meet the extra cost of this system of distribution. It is estimated that only one-tenth to one-fifth of the distribution area will stand the cost of conduits.

An ideal system in large cities would be to carry the sewers, water and gas mains, electric cables, etc., in large conduits occupying the spaces under the sidewalk. Not only would they be accessible, but this system would put a stop to the cutting up of the street surfaces in making connections and in similar work.

Handling proportional concrete in wagon loads has been found economical in some instances. The cement, sand and stone are placed in a dump wagon in the proper proportions, hauled to the mixer and the horse unhitched. A locomotive crane lifts the wagon to a point directly over the mixer, when the wagon is dumped.

Puntledge Hydro-Electric Power Plant

An Ultimate Development of 19,000 h.p. which will Supersede Separate Steam Plants Used for the Operation of Coal Mines at Vancouver Island

CANADIAN Collieries (Dunsmuir), Limited, owns and operates a group of coal mines in the vicinity of Union Bay, Vancouver Island, B.C. The power for the operation of these coal mines has been generated heretofore by separate steam plants located at the various mines. About three years ago the problem of renovating and expanding some of these steam plants presented itself for solution.

General estimates were made of the capital cost of such improvements and also of a central steam-electric power station with a distribution system to the respective mines. At the same time surveys were made to determine the cost of hydro-electric power for the same purpose. Comparative estimates showed that with coal possessing a calorific value of 14,000 B.t.u. at $2.50 per ton delivered at the power station the cost of installation and operation was greatly in favor of the hydro-electric development, which method was accordingly adopted, resulting in the construction of a hydro-electric plant on the Puntledge River from specifications and detail designs prepared by the firm of H. K. Owens-A. V. Bouillon, civil and mechanical engineers, of Seattle.

General Layout of Plant

This river is the outlet of a lake of the same name with an area of approximately 9 sq. miles and a low water surface elevation of 420 ft. above sea level, its outlet being about 8 miles from tidewater. Puntledge River has an observed flow ranging between 330 and 3,500 sec.-ft. and by building an impounding dam at the outlet of the lake to raise the water 23 ft. and cutting the bottom of the outlet to a depth of 5 ft. below low water an available storage capacity of 23 ft. of depth is obtained, which is equivalent to about 132,000 acre-ft. Considering with this the regimen of the river as recorded during the short period of observed flow, it is estimated that a constant flow of at least 800 sec.-ft. can be maintained for use in the development of power. The rated capacity of the ultimate plant will be about 19,000 h.p. at the turbine shaft. This being in excess of the requirements for the owner's own industries, the spare power is intended to supply other industries either established or contemplated in that vicinity.

From the impounding dam the water flows in the natural bed of the river to an intake reservoir formed in the bed of the river by a diversion dam about 2½ miles below the lake. This dam consists of a spillway and an intake with head gates, which divert the water for power development into a canal and flume line 3,400 ft. long, the latter discharging into a forebay forming the intake of the penstock system.

From the forebay the water is carried in a wood stave pipe 8 ft. in diameter and 5,380 ft. long to a Y structure with two outlets for pipes 6 ft. in diameter fitted with gate valves. Only one-half of the ultimate penstock system is now built from this Y to the power house, and the next section of the present system consists of one line of 6 ft. stave pipe, which is to be duplicated at some future time. This pipe is 4,500 ft. long and leads to a junction structure having inlets for the two 6-ft. pipes and outlets for four 50-in. penstocks, the interior of the structure forming a chamber common to all connected pipes. Gate valves are installed here at both the inlets and the outlets. There are to be four penstocks in the completed system, but only two are constructed for present purposes. These 50-in. pipes are built of wood staves and steel bands for a distance of 3,170 ft.; for the remaining distance of 660 ft. to the power house the pipes are built of steel. Only one-half of the projected generating machinery has been installed, consisting of two reaction-type turbines with horizontal shafts direct-connected to generators of the alternating-current, revolving-field, twenty-five-cycle, three-phase type.

The plant differs but little in general outline from the usual scheme of any similar hydro-electric development, but in detail there are some features which are of unusual design.

Impounding Dam

The impounding dam is approximately 300 ft. long, with a crest elevation of 445 ft. and a gate sill elevation of 416 ft. The gateways in this dam, together with spillways aggregating 100 ft. long, give a capacity of flood discharge of 10,000 sec.-ft., which is in excess of the highest recorded outflow from the watershed. In general type the structure is a buttressed wall of concrete partly reinforced. A special feature of the dam is a log sluice required by the Government regulations. This was accomplished by omitting the wall in one of the panels and substituting stoplogs laid one over the other and readily removable one at a time to obtain the necessary depth for the passage of logs at any stage of water elevation. The storage of water and its flow over the spillways are controlled by wooden needles closing the spillway wickets, and are so made and installed as to be readily removed in time of flood. These needles are made of 3 x 4 in. lumber, 12 ft. long, dressed to 2⅝ x 3⅝ in. and fitted with forged ends for protection and handling.

There are six gateways, each 5 x 6 ft., controlled by steel gates of the butterfly type with vertical axes. The gates are stepped in bearings, set in the sill and the spindle extends to the gallery at the top of dam and through a cast-iron pedestal frame which carries the weight of the gate and spindle and a worm-operating gear fitted with double hand cranks. The gates fit loosely into the sluiceways, as there is no intention to obtain water-tightness, and their vertical position is adjustable at the overhead thrust bearing.

The dam is built on solid rock. The concrete is composed of ordinary aggregates in the proportion of 1 Portland cement, 2½ sand and 5 gravel, with approximately 10 per cent. of hydrated lime added to the cement as a neutral filler to obtain watertightness. To insure against uplift of the structure from pressure in horizontal seams, which might exist in the underlying rock, a number of weep holes were drilled in the rock and were fitted with pipes leading up and out to the downstream face of the dam.

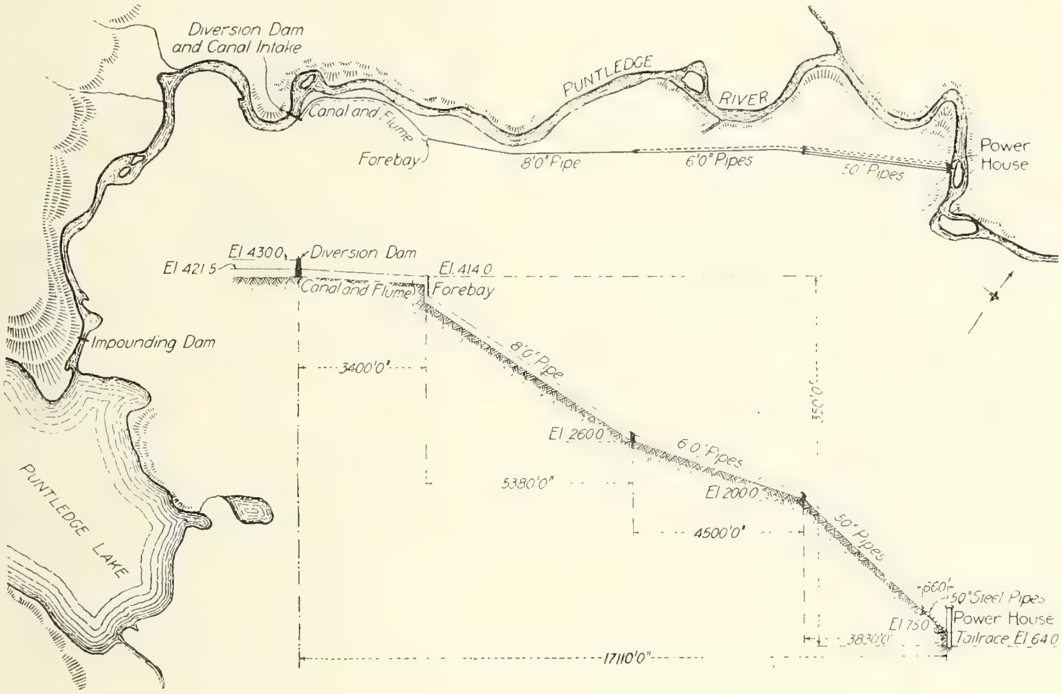
Diversion Dam

The diversion dam is also of concrete, partly reinforced at the intake end. The spillway is 100 ft. long.

As the Government regulations required a fish ladder, one was built in one of the concrete abutments so as to be protected from damage in time of flood. There are two 6 x 7 ft. gateways in this dam. The gates are of steel plates rivetted on steel channel frames and are fitted with rollers. Watertightness is obtained by flexible diaphragm strips bearing upon the face of the gateway along the sides and top and by a cushion on the bottom, which is seated on a steel channel sill laid inverted in the concrete floor. The gateways are protected by sectional steel screens designed for convenient handling and upkeep. The lifting gears for the gates are of the rising screw-stem type, the stems being 2½ in. in diameter with bevel-geared operating stands and hand cranks located on an overhead working platform.

Canal and Flume

This part of the work has alternating sections of canal and flume, in which there are many sharp curves, necessitated by the broken nature of the ground. The canal sections occur in solid rock, sand, gravel and clay, all being lined with concrete except some parts cut through impervious clay. The intermittent sections of canal are connected by a wooden flume built of staves laid on steel suspension rods carried by and between side girders laid on bents placed 16 ft. center to center.



Plan and profile of the Puntledge River hydro-electric power plant.

The flume is approximately semicircular in shape, 12 ft. wide and 7 ft. deep; the staves are made of 3 x 6-in. lumber, dressed to 2 9/16 x 5 7/16 in.; the suspension rods are ¾ in. and are adjustable over each girder by screw ends, with nuts over specially designed washers. These suspension rods are spaced 24 in. center to center. The girders are built up of double fir timbers 8 x 16 in., with space between fixed by separators and through which the suspension rods pass. The flume bents are built on concrete piers, except across a swamp, where the flume is carried on piles driven to solid bottom.

The canal and flume line terminates with a short section of reinforced-concrete canal, the shape of which is gradually adjusted for proper entrance into the forebay structure, and before reaching the forebay one side of the canal is formed into a spillway of capacity sufficient to carry away the entire flow to this point. A rotary balanced steel gate of the Tainter type and operated by a hand gear is installed at the canal entrance to the forebay to regulate or to shut off the supply from the canal and flume line. This gate is 12 ft. wide and approximately 10 ft. high. It consists of two main arms made of steel channels gusseted to the gate frame. The gate is balanced by a cast-iron beam of heavy section, fitted as a spreader at the end of the supporting arms which extend from the trunnion bearings within the forebay for this purpose. Watertightness of this gate is obtained by flexible diaphragm strips fastened to the sides of the gate and sliding in grooves formed in the side walls of the canal. The seats for the strips are brass bars laid in the grooves and secured in the concrete. The bottom of the gate is fitted with a soft cushion which seats on the concrete floor of the canal; and while it was not intended to have this gate absolutely watertight it is found to be practically tight in actual service, and it works well in other particulars.

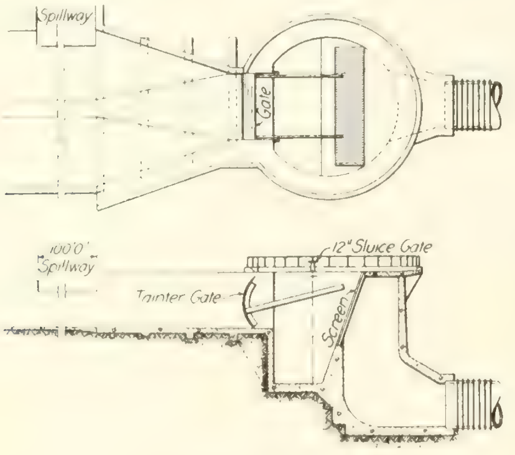
Forebay

Essentially, the forebay structure is a vertical reinforced-concrete cylinder, with the canal entrance on one side and the pipe intake on the opposite side. The basin formed by this structure is divided into two sections, which are separated by a weir and screens. The section into which the canal discharges forms a sedimentation basin with floor sloping to a sluicegate; the other section forms the intake of the penstock pipe and is completely inclosed.

The concrete in this structure is composed of the same aggregates as already specified for the impounding dam, including the same proportion of hydrated lime, and it is found to be watertight in service. The outlet connection of the 8-ft. pipe is funnel shaped, 12 ft. in diameter at the inner end and tapering to 8 ft. in diameter in 7 ft. of length. For connection with the wood-stave pipe a cast-iron ring was laid and anchored in the concrete at the mouth of the outlet, the cross-section of which forms a rabbet for the pipe staves with tapering clearance which provide calking spaces all around the pipe outside and at the end of the staves inside. The calking materials used are oakum and lead wool, and the joint thus obtained is very satisfactory.

Stave Pipes and Shoes

The staves in the 8-ft. pipe are made of lumber 4 x 6 in. finished to a thickness of 3 9/16 in. and an outside width of 5 9/16 in., there being fifty-eight staves in the circle. The staves for the 6-ft. and 50-in. pipes are made of lumber 3 x 6 in. and are planed to a thickness of 2 9/16 and 2½ in. respectively and maximum widths of 5⅝ in. for the 6-ft. pipe and 5 9/16 in. for the 50-in. pipe, forty-three staves forming the full circle of the former and thirty-one staves the same in the latter. These staves are all made of Puget Sound or Douglas fir, in the specifications for which clear lumber was required and sap excluded. The stave ends are grooved for a steel tongue ⅛ in. thick and 2 in. wide, which provides watertightness at the stave joints. The bands as adopted for all pipes are uniformly 1 in. in diameter, the maximum spacing being 12 in. center to center; but this spacing occurs at the upper end of the 8-ft. pipe only; the minimum spacing is 2 in. center to center, which is as close as bands and shoes of the size adopted can be laid, and where the load is reached requiring spacing below said minimum the size of the piping is changed. It was this feature of the design which determined the lengths of pipes of the respective sizes in the penstock system, according to the brief description first given.

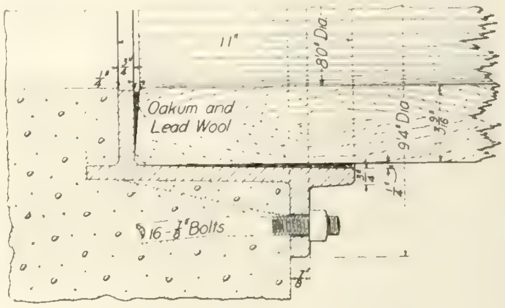


Detail of forebay.

The bands are made in two sections, one having threaded ends and the other button-head ends. The threads are rolled on. Each band has two coupling shoes of malleable iron. A great deal of study was given to the design of the shoes or couplings for pipe bands and a number of standard shoes offered by manufacturers were examined, and some were tested with a view to their adoption, but none of the ready-made shoes offered was found satisfactory, it being apparent that the types of the larger sizes of shoes offered were mere expansions of original designs of shoes for bands and pipes of comparatively small sizes, without adequate provision or increase in scantlings having been made to balance the increases in sizes of either pipes or bands. The shoes used on the various pipes of this system were therefore designed especially to meet the actual requirements. In testing some of the ready-made shoes offered it was found that the threaded end with nut and washer would easily slip off when under stress, even before any noticeable deformation of the shoe would take place, and some of them had such a narrow margin of safety in this particular that they would not be safe to use on pipes of any considerable size. Careful attention was therefore given to this feature of the design of the shoes.

On the shoes for 50-in. pipe a declivity as well as a dish is provided in the face of the lugs to securely hold the band end; this was considered safe for the pipe of this size and curvature of band, but for the pipes of the larger sizes, the curvature of the bands being less and the tangent end longer, it was deemed necessary to provide more declivity in the face of the lugs and to use tapered cast washers, which lock the ends in place. Shoes of each size were made from preliminary patterns, and tested and guided by the results of these tests the patterns were modified slightly as deemed advisable until shoes were obtained in which the strength developed equalled the average elastic limit of the bands. The weights of the respective shoes was held, at the same time, to the minimum curvature with their strength as thus determined. In other words, the shoes of the three sizes as designed for these pipe lines are proportioned to withstand without any deformation the load which the band is capable of carrying to its elastic limit.

Manholes are fitted to the wood-stave pipes at intervals, and particularly at summits, where they are provided with automatic air valves for the outlet of air during service as well as for the inlet of same when the pipes are to be emptied. The manholes consist of cast-iron saddles with lugs designed to receive the band heads, but the extreme side bands pass over the saddles, thus acting to clamp them on the pipe, no other means being used to secure the castings to the pipe. The manholes are closed with cast-steel covers bolted on the facings of the saddles. The stave pipes are laid in a shallow trench for practically the whole length, although in a depression for a distance of 820 feet it was deemed more advantageous to hold the grade line elevated and to place the pipe on concrete piers. This section occurs on pipe 6 ft. in diameter, and the general design of the reinforced-concrete piers, which are placed 16 ft. between centers, is shown in one of the illustrations.



Wood pipe junction with forebay

Y Junctions

Several designs were considered for the structures forming the junctions between the pipes of the different sizes. The first design was for structures built of steel plates rivetted in alternative forms of wyes and cylindrical headers; but after considering the size of the structures, range and nature of the stresses introduced by attaching to them stop valves in the penstocks, the designs of rivetted plates were set aside as unreliable, although the element of cost as between that type of structure and the design finally adopted was another factor in favor of the latter. The next design considered was for structures of cast steel, with the idea that steel castings could be made more rigid than the rivetted steel structures and could easily be provided with suitable means for anchorage; but the cost of such structures, including the necessary foundations for support and anchorage, was also found to be excessive. The design adopted was one in which foundations and anchorage were most conveniently combined, and the design to which the structures have been built is reinforced concrete, a type of construction believed to be unusual for such high-pressure work. The junction between the 8-ft. pipe and 6-ft. pipes was designed for a maximum internal pressure of 115 lb. per square inch, and that between the 6-ft. and 50-in. pipes for a corresponding pressure of 160 lb. per square inch. The 8-ft. pipe connects directly with the first-mentioned structure, and the joint is made in a cast-iron ring set in the concrete forming a bell end for the wood pipe. Watertightness at the joint is obtained by the same means as described for the joint made where the same pipe leaves the forebay structure.

All other pipe connections with these concrete structures are made by means of flanged cast-iron sleeves set in the concrete to which gate valves are attached. The purpose of these gate valves is to enable the isolation of any one of the connecting pipes and the operation of the plant with one or other of the 6-ft. penstocks and any one or all of the four 50-in penstocks, which explains the reason for making the lower-junction structure a chamber common to the two inlet pipes, the four outlet pipes thus providing a by-pass connecting all sections of the penstock system. But, as will be readily understood, the introduction of stop valves in the penstock complicated the problem presented for solution in the design of these junctions, as forces of magnitude are thus developed which are not encountered in open-way penstocks, and it was the adaptability of reinforced concrete to designs meeting all conditions that prompted its adoption for such unusual duty.

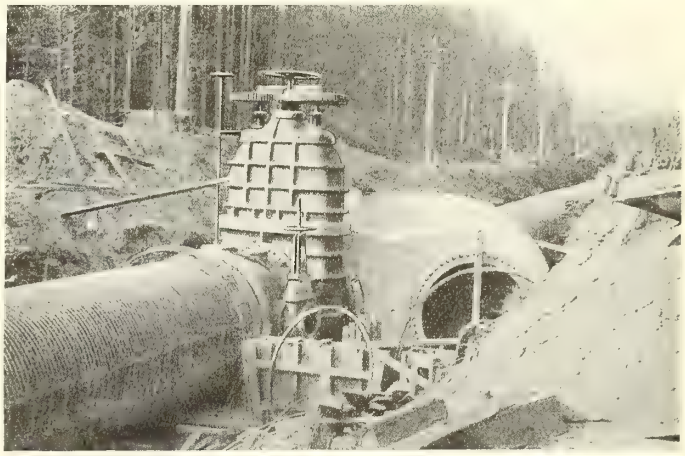
The branches from these junction structures leave at an angle to the axis of the pipe line and the alignment of the stave pipe parallel to such axis is restored at a short distance below each respective structure by means of cast-iron pipe bends laid next and bolted to the valves and which are fitted with manholes, air valves and relief valves, the latter consisting of a flanged gate valve bolted to a facing on the side of the cast-iron bend with a bursting-plate cover bolted to the outlet.

Bursting Plates

The bursting plates consist of cast-iron flanges, or rings, within which is a cast-iron plate turned to such size as to leave an annular space of about ⅛ in. The inner edge of the flange or ring and the outer edge of the plate are made with a groove which is narrower in the edge of the plate than that in the edge of the ring. The annular space, which, together with the grooves, forms a cross of irregular shape in section, is filled with lead calked watertight, the idea of the design being to shear the tongue of lead formed by the groove in the edge of the plate and thus to release the latter in the event of unexpected excessive load. To accomplish this without undue friction the edge of the plate is turned with a taper, as shown in the drawing. The thickness of the inner tongue of lead is 3/16-in. in both sizes of plates, this having been determined after tests were made to ascertain the average shearing strength of the tongue under such conditions automatic air valves are fitted at these structures both for escape and inlet, the latter being essential to prevent a vacuum forming in and possible collapse of the pipe in the event that it should be emptied rapidly.

Waterproofing

Watertightness of the concrete structures was obtained by building the walls proper to within a thickness of 2 to 3 in. of the inner surface of rich Portland cement concrete, composed of fine aggregates of measured density, weight tests having been made to determine the proper proportions of the available aggregates for maximum density; and great care was exercised throughout to insure uniformity of mixture. The proportions in this concrete averaged 1 cement, 1 sand and 2 gravel, the latter varying from pea size to 1 in. The inner thickness of 2 to 3 in. was made up of Portland cement mortar of the composition of 1 part cement to 1½ parts of sand, the inner surface of this mortar coating being covered with several coats of asphalt hot. In the chamber of the structure for the junction of the two 6-ft. penstocks with the four 50-in. penstocks, only one-half of which is being utilized for the partial plant now built, the side which is not connected up is separated from the other by a removable wooden bulkhead, provision for which was made in the structure in the way of rabbets armored with steel shapes set in the concrete. This feature of the design was provided on both sides in order that similar isolation of one side or the other can be readily effected at any time in the future should such be necessary. As indicated by the design, the anchorage of the concrete structures is accomplished by means of reinforced walls, approximately 7 ft. deep, buttressed to the wye structure and to the apron which forms the foundations for the valves and heavy cast-iron connections, the design providing amply against the overturning moment, as well as against sliding. The apron referred to constitutes also the floor of a drainage basin for the relief valves, the outlet of which is an open ditch to lower ground, with natural drainage to the river.



Upper Y, where 96 in. pipe branches into two 72 in. pipes.

Lower End of Penstocks

Where the minimum spacing of bands is reached the type of construction is changed to steel pipes connected to the stave pipes by means of rivetted steel tapered sections joined with the wood-stave pipes in a bell end provided in the steel section for the wood staves, of such shape as to allow calking at the outer end of the steel section, as well as against the inner ends of the staves. This steel section has angle-bar anchorage rings rivetted on and is set in a concrete anchorage block forming the base of a chamber giving access to a manhole fitted on this section. The steel pipe, which is of the lock-bar type, is rivetted to the special steel section just described. Each of these steel-pipe penstocks is 660 ft. long, their thickness varying from ⅜ in. at the upper end to 7/16 in. at the power house. The steel pipes are laid in trenches, much of which is in solid rock, and at about the middle of their length there are expansion joints, consisting of steel castings and of the usual packed slip-joint design. These joints are laid each in a concrete chamber and the steel pipe is laid in tarred felt through the walls of this chamber, leaving it free to slip. The lower ends of the steel penstocks are anchored near and at the power-house foundation and terminate within the building, with a cast-iron closing piece connecting them to hydraulic shutoff valves installed at the respective turbines.

Power House

The power house is built of reinforced concrete on a rocky site at the river's edge. Approximately one-half of the principal building contemplated has been erected for the accommodation of the present units, but the annex section of the building, which contains the switching and other electrical apparatus and the wire outlets, is built complete. Provision has been made in the design for extension of the main body of the building to house the remaining units without disturbance to the operation of the present plant.

The annex section, which is three storeys high and has a 18½ x 65½-ft. floor area, has the upper floors of concrete supported by I-beams. The roof of the entire building is built of concrete laid on Hy-Rib reinforcement plastered underneath. The roof framing of the annex section consists of 9-in. 21-lb. I-beam rafters; that of the main section consists of steel trusses placed 20 ft. center to center, supporting 9-in. 21-lb. I-beam purlins. The sides of the building are, in large proportion, of glass. The main building is designed with crane girders, on which a traveling crane having a lifting capacity of 40 tons has been installed. These girders are of reinforced concrete, with the runway rails embedded therein. All of the concrete in the exterior of the building was made of waterproof composition obtained by the use of hydrated lime in the mixture in the proportion of 10 per cent. of the cement used, and the roofs are covered with roofing felt. The roof drainage is run through the interior of the building to a central drain to guard against frost in the conductors.

Scheme of Regulation

The static head is 350 ft.; the length of the penstock system being 13,700 ft., the ratio of the pipe is about 1:40. The part played by a high ratio of head to length of penstock, as an unfavorable factor in the solution of the problem of power regulation under variant-power-load conditions, was fully realized and much study was given to the general scheme with a view to obtaining the most favorable combination, but the ratio obtained was the best available owing to the naturally unfavorable topographical conditions and to the fact that the forebay is located at the nearest suitable point in relation to the power house, the general slope increasing from this point gradually to the power-house site. The problem presented in laying out the penstock system from the site selected for the forebay to the power house was therefore confined to locating the best available grade line, considering the details of construction and existing property lines. In a penstock system of such a high ratio of length to head it is difficult to obtain power regulation by means designed to conserve the water supply, but inasmuch as there was no scantiness of supply and economy of water was not a factor in the design of this plant the problem of regulation as presented was comparatively simple.

The arrangement adopted insures against sudden or high rises in pressure in the penstock system as an effect of throttling of the turbine gates by the governor gear of each turbine operating a relief valve on its penstock, which opens and closes synchronously with the corresponding action of the turbine gates, thus permitting water to waste in approximate proportion to the load taken off, and maintaining so nearly a uniform rate of flow in the penstock as to prevent the pressure rises due to governor throttling to exceed a nominal percentage of the pressure due to the active head. This valve is geared so as to be adjustable to close in any desired length of time, so that waste of water need be no more than sufficient to diminish the penstock flow at a safe rate.

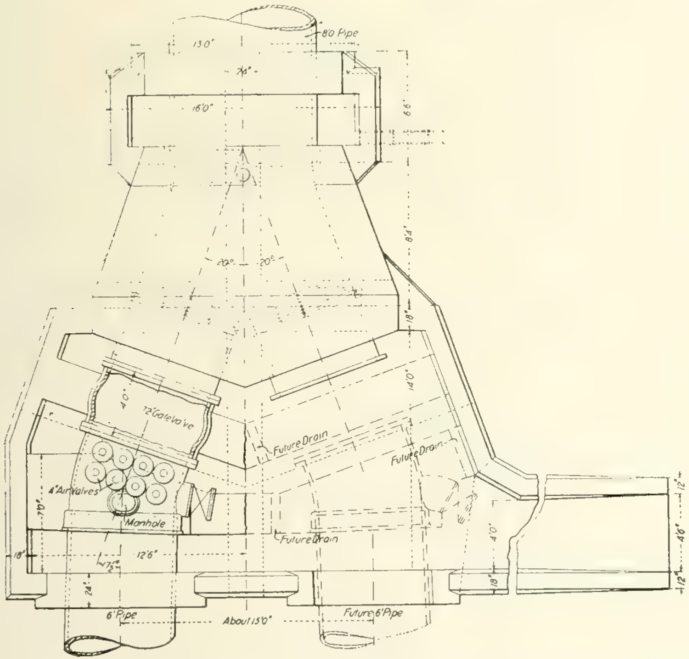
The general arrangement as designed includes, in addition to the governor actuated relief valve, a direct-pressure independent relief valve which would open in the event of extraordinary rise in pressure caused, for instance, by an impediment or accident occurring to the governor gear. In addition to the governor actuated relief valve, a direct-pressure independent relief valve which would open in the event of extraordinary rise in pressure caused, for instance, by an impediment or accident occurring to the governor gear. In addition to the valves described there is a safety relief consisting of a bursting plate closing the end of a nozzle, which terminates each penstock in the power house, so that in the event of accident to the governor gear and relief valves any abnormal or dangerous rise in pressure would be prevented by the blowing out of such bursting plate.

Turbines

Reaction type turbines with governor control effected by multiple balanced gates at the inlet, actuated by the governor gear, have been installed. A hydraulic shutoff valve is placed in each penstock in conjunction with the turbine. These machines are direct-connected to their respective generators. Specified rating of each turbine is 4700 h.p. under the conditions to be obtained when the penstock system is completed, and supplies four units at full power, for present purposes only two of these units are installed, and inasmuch as the upper portion of the penstock system is already constructed of the requisite capacity for four units the available power of the two turbines now installed exceeds their rating to the extent of 28 per cent. in the case of one turbine operating alone and 7½ per cent. when both are running at full gate. In general arrangement within the power house the machines are placed with the shaft axis parallel with the longitudinal axis of the building. The floor space required for the installation of each unit is 32 x 50 ft. and the floor space dimensions of the ultimate power house, as designed, are 34 x 214 ft. The floor-space dimensions of the main building as far as constructed for the accommodation of the present units is 34 x 117 ft.

The alternating-current generators are of the waterwheel type, with the lower portion suspended from the foundation piers within the foundation pit. These machines are designed for a normal constant output of 3,500 kw. at 500 r.p.m. and 13,200 volts, and they are capable of carrying a 25 per cent. overload continuously. Each machine has its exciter direct-connected, the capacity of one exciter being sufficient for two machines when operating at 80 per cent. power factor.

In the concrete floor and foundations are laid the electrical conductors from the generator pits, and the leads are accessible at numerous points in manholes and tunnels. The grouping of the leads from the switchboard and switching apparatus is effected in a central tunnel. The switchboard and control station are placed on an extension of the second floor of the annex, projecting as a gallery within the main portion of the building, from which the full interior of the power house proper is visible to the operator. The switching apparatus is located on the second floor and is contained in a series of reinforced-concrete cells. Six lightning arresters are located on the upper floor, and from these the transmission lines pass out through the side of the building, with the usual insulated wall entrances and attachments, which are protected by a 6-ft. awning extension of the roof.



Detail plan, showing general arrangement of upper Y branch.

The plant is now in operation and its performance is meeting all expectations. It will be noted that the storage and diversion works, water conduit, forebay, wasteway and the upper third of the penstock system are completed for the full capacity of four units, while the lower two-thirds of the penstocks are completed only for supply to the two of these units now in operation.

The cost of the plant as now constructed figured on the basis of the normal output capacity of the two units installed is less than $70 per horsepower at the power-house switchboard, and the corresponding cost will be reduced to less than $60 when the plant is completed and the output of four units is used. The proportional costs of this plant per unit of capacity as stated are considerably lower than the average cost of such plants, and in fact they will compare favorably with the lowest costs for similar plants. Considering the permanent character of the work throughout, the isolated location of the plant in relation to the material and labor markets and the fact that a great deal of material and appliances required for its construction had to be imported and were subject to heavy customs duties these low costs reflect efficient design and construction.

Equipment

Generators and electrical apparatus were manufactured and installed by the Canadian General Electric Company.

Turbines with governor gear, the relief valves and hydraulic penstock-stop valves were furnished and installed by Escher-Wyss & Company, of Zurich, Switzerland.

Gate valves, 50 and 72 in. in diameter, installed in the penstocks were furnished by the Crane Company, of Chicago, through its branch house in Vancouver, B. C.

Air valves are of the Crispin type; those for outlets up to 4 in. are single units; those for outlets exceeding 4 in. are made in clusters of 4-in. units. These valves were also furnished by the Crane company.

The lock-bar steel pipe 50 in. in diameter, was made by the East Jersey Pipe Company, of Paterson, N.J.

The power house and hydraulic development constituted a general contract, which has been performed by Grant Smith & Company, contractors, of Seattle, Wash. Briefly, this contract embraced all of the work from the clearing of the land to and including the power house, with the exception only of the machinery and power-house apparatus. The work was begun in the late fall of 1911, and while no unusual difficulties were encountered much delay was caused by extraordinarily high water and inclement weather.

The construction of the plant and installation of the machinery were supervised by the Canadian Collieries (Dunsmuir), Ltd., of which Mr. W. L. Coulson is manager and Mr. Joseph Hunter is chief engineer. They were represented on the work by Mr. L. Netland, resident engineer.

The materials, fittings and structural parts purchased for the power house and hydraulic development were inspected and tested at the various places of manufacture by Robert W. Hunt & Company, under the general instructions of Canadian Collieries (Dunsmuir), Limited, and the consulting engineers.

Plans and specifications for the work, including the detail drawings, were furnished by H. K. Owens-A. V. Bouillon, consulting, civil and mechanical engineers, of Seattle.

Timber in Exhibition Building

The machinery hall being constructed for the Panama-Pacific Exhibition at San Francisco, which, according to the Engineering Record, is to have a floor area of eight acres, a length of 967 ft., a width of 367 ft., and an extreme height of 135 ft., is being built entirely of timber, and will form one of the largest buildings erected in that material. In ordinary circumstances steel would have been adopted for the work, but the proximity of the Pacific Coast forests renders wood more economical. In order that the building may be completed in time for the celebrations in 1915 the contract requires that the operations shall be finished in 240 days. In consequence of this stipulation, it is necessary to hasten the work as much as possible, and during one week timber amounting to 600,000 ft. b.m. has been placed in position, while in four hours 55,000 ft. b.m. were erected. The total amount of wood required amounted to 7,500,000 ft. b.m., and the average number of men being employed is 475 a day.

Highway Bridge Construction—Part III*

By F. Tissington†

Laterals or Wind Bracing

THESE are generally composed of single angles and in the majority of cases for trusses under one hundred feet span, the minimum size angle 2½ x 2½ x 5-16 will be found sufficient. For trusses with longer spans a slight increase in the sectional area of the laterals at the ends will be necessary. Naturally the angle of inclination these make with the chords will affect the stress.

These members are attached to the lower chord (and upper chord of through trusses by means of gusset plates rivetted to the panel points. (See Fig. 7).

Brace or Sway Frames

In through trusses it is usual to provide a series of these frames (see Fig. 4), i.e., one at each pair of posts and there are generally regulated in depth to just clear the headroom allowance specified. This clearance is generally not less than fourteen feet above the roadway level. The top and bottom members of these frames should be designed to act as a strut between the two trusses with a maximum ratio of l/r of 150. This allowance, it will be noted, is twenty-five per cent. in excess of that required for the posts and struts in the truss members. The other members are purely nominal in size for the usual run of highway bridge work.

The addition of these frames serves to break up the length of the posts as well as to impart a good deal of stability to the top of the structure.

Portals

Quite a number of different styles of portals have been designed from time to time, but for simplicity and low cost of manufacture, the writer prefers the same style as adopted for the sway frames. Practically the same remarks quoted for the sway frames will apply in this case, but it should be borne in mind that at least half the accumulated stress due to the wind pressure on the top chord has to be transmitted through this frame to the leeward end post.

Handrailing

Usually both trusses are filled in with a latticed handrail about three feet deep arranged with the bottom chord about six inches above the wheelguard.

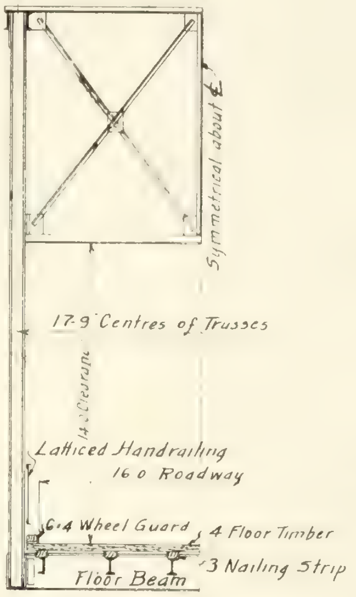


Fig. 3

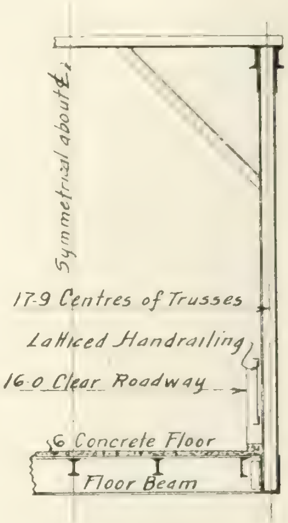


Fig. 4

These are indicated in Figs.1, 2, 3 and 4 in section, and also on the general drawing Fig. 8 accompanying this article. It is permissible to use smaller and thinner sections than the minimum sizes fixed for the trusses, as the junction of this railway is only to close up the openings between the truss members. The lacing bars are alternately of angle and flat section, the angle being 1⅛ x 1⅛ x ⅛ and the flat bar 1⅛ x ⅛. The top chord has to withstand a horizontal pressure of 45 lbs. per foot run and must be designed accordingly. The railings as a rule terminate with an orna-

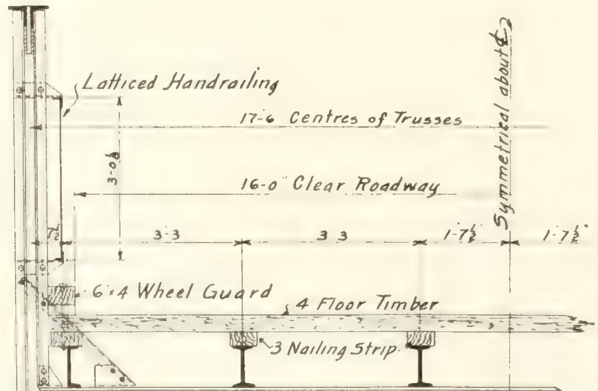


Fig. 1

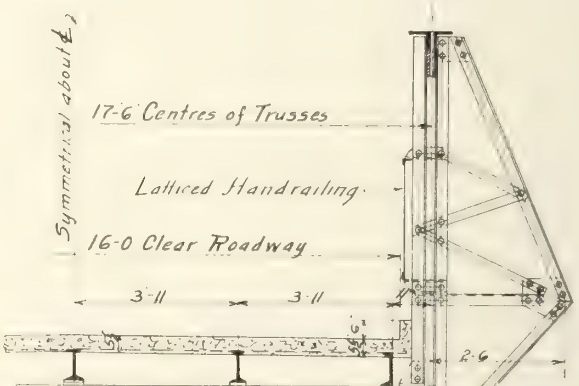


Fig. 2

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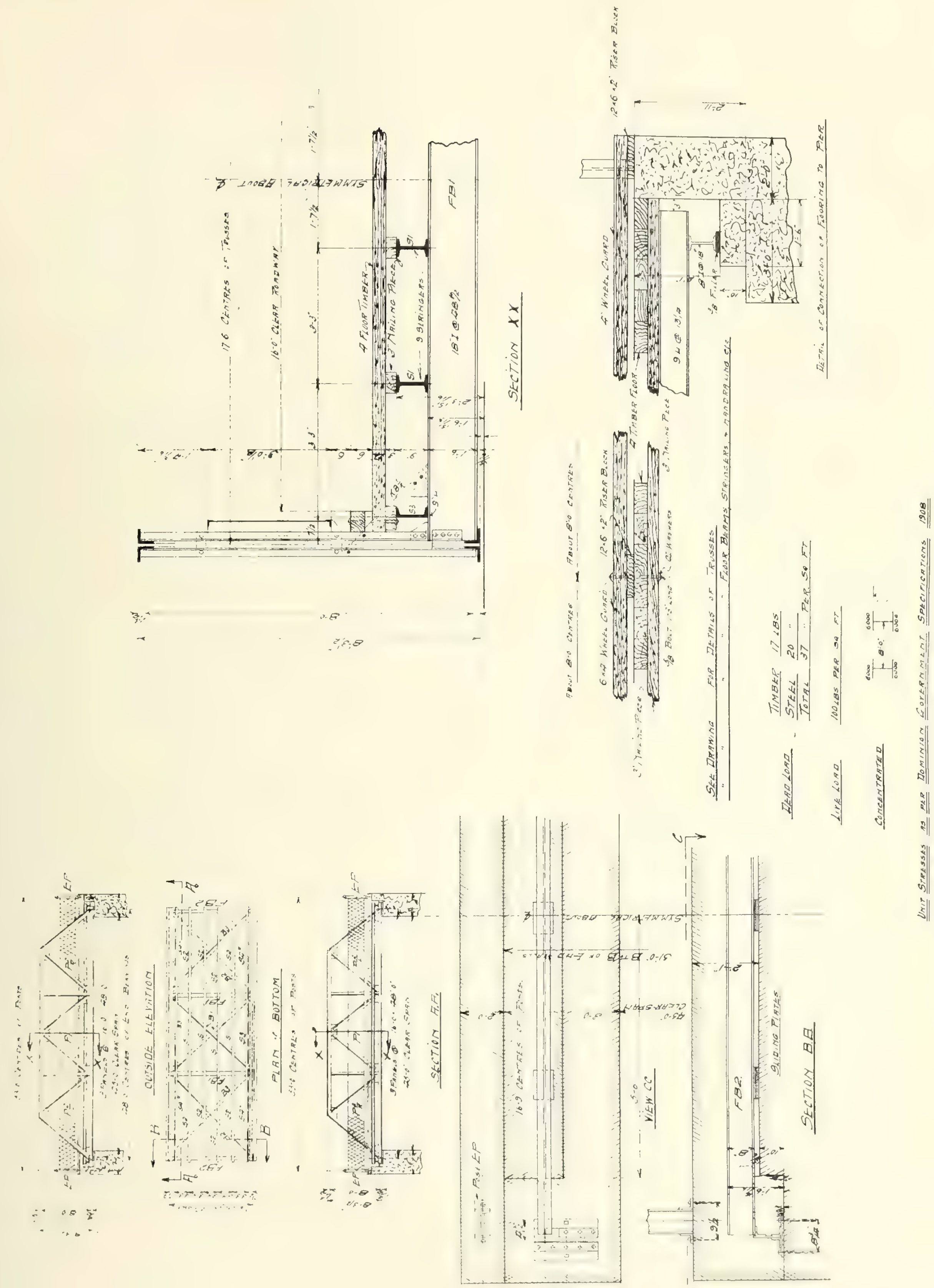
[*] Parts 1 and 2 were published in our issues of Sept. 3 and Sept. 24 respectively.

† Chief Draughtsman, Mackinnon Holmes & Co., Sherbrooke, Que.



General arrangement and erection diagram for 48 ft. span c. to c. highway bridge.

mental post placed at the centre of the back wall on the abutments. The position of this is also indicated in Fig. 8.

Roller Nests, Sliding Plates, Etc.

All trusses of 80 ft. span and over should have roller nests arranged at one end of the span. These are of a simple type consisting of a series of rollers held in position by a cage and running between two machined plates, one rivetted to the end of the bottom chord and the other fastened to the abutments. Under 80 ft. span these roller nests may be replaced by a sliding plate. The bed plate rivetted to the underside of the bottom chord of truss being provided with slot holes to allow for expansion and contraction.

General Drawings

Fig. 8 gives a comprehensive idea of the usual type of erection diagram and general drawing necessary to provide for the contractor of the substructure, the erector for the steelwork and for the laying of the floor timbers.

Weights of Highway Bridges

Table 8 gives the weights for a few examples designed to meet the requirements of the Quebec Government. The whole of these were laid with timber floors. Most of the weights given represent actual material used in manufacture.

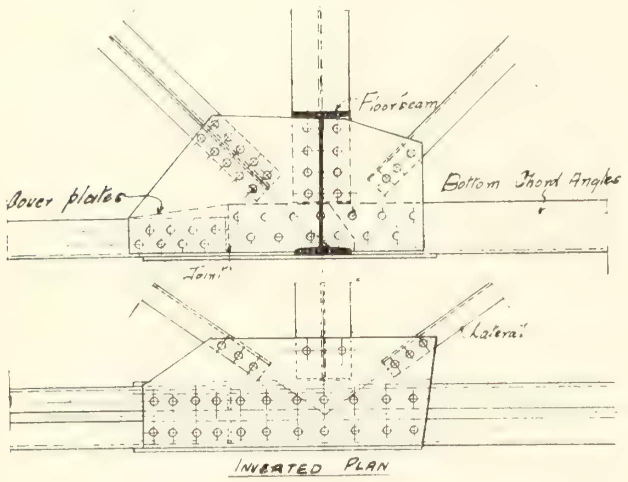


Fig. 7

Erection

Local conditions generally play havoc with office arrangements and it is therefore wise to study this subject at the site if the size of the span warrants it. Generally, however, the elimination of as much field rivetting as possible is a point to the good. Also, another line of policy that has been found economical is to build each truss up complete in the works and seam all field connections before despatch.

If a proper system of marking is used there should be no difficulty in repeating the performance with ease in the field.

A reinforced-concrete pontoon crane, 100 feet long by 43 feet wide, fitted with a motor and screw and capable of being navigated by its own power, has been constructed at Marseilles. It is to carry a crane 33 feet high, with an overhanging or unsupported length of 33 feet, able to support a load of 30 tons. The pontoon has double sides, protecting it against the influx of water should the outer skin be damaged.

Waterproof Concrete Paints

THE committee on treatment of concrete surfaces of the National Association of Cement Users has investigated a number of the so-called waterproof concrete paints and finds that they are much more efficient than colorless solutions.

These paints may be divided into two classes: First, those which give white, or light tints, or other colors pleasing to the eye and of a decorative nature; and, second, those which employ compounds of tar and asphalt which are necessarily black, or nearly so, and are, therefore, seldom used on exposed surfaces.

The presence of a finely-divided pigment serves to seal up the small pores in the surface of the concrete, leaving less work to be done by the vehicle.

In most cases the proportion of pigment used is small, and by using a cement color but little change in the surface appearance of the concrete need be made, unless desired, while on the other hand, almost any shade of color may be obtained. In this way the waterproof-coating is made more serviceable and at the same time ornamental.

All these treatments are applied with a brush in the same manner as paint and are probably as durable on concrete as paint is on wood.

Linseed oil paints should not be applied directly to new concrete, or to any concrete which has not been long exposed to the weather. The free lime in concrete not thoroughly weathered out on the surface by exposure to the elements will saponify the oil, destroying its adhesive power and its life, and the paint will soon peel off. After concrete has been exposed for a long time to the elements, linseed oil paint may be used with greater safety. It is difficult, however, to determine when the concrete is sufficiently free from lime to render it safe for the application of linseed oil paints, and it is therefore safer to avoid their use directly on concrete.

There are preliminary applications which may be given to concrete which renders it harmless to linseed oil paints. The best known, and perhaps the most thoroughly proved treatment of this kind, is that devised by Charles Macnichol, of Washington, D.C., and published in the transactions of the American Society for Testing Material for 1910. It consists in giving the concrete, after it has been thoroughly set, a priming coat of a solution of zinc sulphate, eight pounds to a gallon of water. This is applied with a brush, and after it is dry ordinary linseed oil paints may safely be applied over it.

The solid substantial business buildings that have been constructed in Winnipeg during the past few years are worthy of note. In 1910 there were nineteen buildings erected at a cost of over $100,000 each. In 1911 twenty-two buildings were put up each costing over $100,000. In 1912 the big buildings costing over $100,000 each numbered twenty-five, and for the eight months of this year Winnipeg has completed sixteen buildings at a cost of over $100,000 each. This year Winnipeg has had three buildings that have cost over $500,000 each, while last year the Government Law Courts was the only permit that exceeded the half million mark. In 1911 the Grand Trunk Pacific Hotel "Fort Garry," was the most costly building erected, calling for an expenditure of $1,000,000, and in 1910 the two largest buildings in the permits were the Bank of Montreal, $950,000, and the Canadian Bank of Commerce permit, $800,000.

Essentials in City Pavements of Concrete

By J. S. McCullough, City Engineer, Fond-du-lac, Wis.

SOME of the things I have found to be essential in concrete pavement construction are:

The sub-grade must be adequately drained and rolled until all depressions are taken out. A uniform compression should be the aim, and on placing a pavement over a wider area than has formerly been travelled care should be taken to get that portion outside of travelled track, as solid as the center of roadway.

When gutters are put in, we require same amount of rolling and compression under curb and gutter as under pavement proper.

The material to be used for aggregate in concrete must not only be clean when delivered on the work, but must be kept clean until it gets into the work. Work has been ruined by allowing clay, loam or other ruinous materials to get mixed into stone, gravel and sand, after it was dumped on the road or street.

Cement should be carefully watched, and frequently tested on the job to guard against insufficient grinding, and also to detect cement damaged in transit, or in warehouse by getting damp or wet. We test our cement for pavement work as it is received, and inspector on street looks out for any particular defective sacks that may have got wet, and partly set.

Where expansion joints are left to be filled later with asphalt extreme care must be exercised in removing templates used to make space. There is danger of pulling up part of concrete in removing the templates and such damaged spots will soon ravel and develop bad holes and ruts. We use a patented wedge for this purpose which enables us to make the space for expansion without any damage to concrete, and the removal of the wedge is no trouble at all.

Our work is all two-course work, and in order to get the top course or wearing surface of the desired uniform thickness we use an adjustable gauge, cut to desired crown of street, which travels on the gutter or curb, as desired and gives us a uniform crown and thickness. This gauge is also used to test sub-grade, and there is no excuse with its use for not getting thickness of concrete called for by specifications.

For wearing surface our idea is that ½ in. thickness in a special rich mix for wearing surface with granite for aggregate, and sand and cement mortar, making a mix of equal parts cement, sand and granite, laid on a base of 1:2½:5 concrete will produce a better pavement, than the same amount of cement put into a one-course job.

We have no washed gravel available, and our limestone is rather soft, so have continued to build two-course work, with granite, sand and cement wearing surface. In our clay soil the changes in sub-base on account of moisture and frost and the temperature changes, have convinced us that a 6½-in. thickness of slab is not strong enough, and we have been reinforcing with a No. 7 triangle mesh wire.[1]

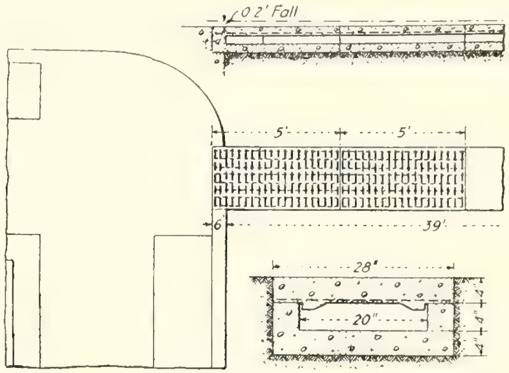
For next season's work we have in mind increasing both thickness of slab, and the weight of reinforcement, and put all the crown of the pavement in the concrete, by making sub-grade flat.

Our pavements are standing well, and the only defect we are trying to overcome is the tendency to crack longitudinally. The cracking does not appear to be a serious defect in the opinion of taxpayers, however, as we have been building concrete pavements in this city since 1908, and with the exception of our first year's work, the pavements have all been laid on petition, from abutting property owners.

We have approximately 10 miles of concrete pavement in the city now, and have petitions granted and on file for more than 3 miles for next year.

Combined Street-Crossing and Culvert

On several of the residence streets in San Antonio, Texas, concrete street-crossings of a unique type have been built under the direction of Mr. A. C. Pancoast, City Engineer. These are designed to serve not only as crossings for pedestrian traffic, but also as culverts to carry storm water from the gutters across the streets to outlets in the creeks and the San Antonio river, which flow through the center of the city. Some such device to take care of surface water on occasion, is necessary from the fact that the city has few large underground sewers owing to the infrequency of heavy rainfall in that section.



Combined concrete street-crossing and culvert

These culverts, as shown in the diagram, are 4 in. high and 20 in. wide, and are poured on the ground, half the width of the street at a time so that the work will not interfere with traffic. The cover slabs are cast as separate units 5 ft. long; and are 4 in. thick, reinforced with 3-in. steel rib metal. They are strong enough to support the heaviest steam rollers. To prevent chipping of their edges, a strip of rock asphalt 2 to 3 ft. wide is laid alongside.

A horse hitched to a heavy truck at Rochester, N.Y., recently caught his shoe on a manhole lid, pulling the cover up as he lifted his forefoot. His hind legs sank through the opening, only 30 in. in diameter, and after many kicks and struggles the animal freed himself from his harness and gradually slipped into the opening until head and forefeet had completely disappeared below the surface of the street. A derrick was summoned, and after much difficulty the horse was hauled out by ropes looped around his neck and front feet. With the exception of a few scratches the horse apparently suffered little from his close contact with 2,500-volt cables in the manhole.

Hardly as lucid as it might be, perhaps; but it shall never be said any novel method of construction was refused notice in our own pages:—"Frank McGuire is building a new house for himself on his lot on the Greenlead Road. He is building the new house outside of the old one, and after the new house is inclosed he will tear the old one down."—From the Ontonagan Herald, Ontonagan, Mich.

Classification of Materials in Constructional Operations

SYSTEMATIZATION of construction work has in the past few years been carried forward to a point hardly dreamed of by the old "rule of thumb" contractors. The great variations occurring in construction work deterred contractors from attempting standardization and systematization to any extent, for they looked at their problem as a whole and became discouraged. The variations, however, can be eliminated or foreseen if taken up one by one, each being solved by itself. It is not the writer's intention in this article to explain how construction work can be systematized, but only to show how by scientific studies made in connection with systematizing work new ideas are developed—for instance, like the one of classifying excavation work by expressing the manner in which the materials are removed and not by the name of the materials.

There is probably no feature of construction work which is more common than excavation. The large work, of course, is handled by machinery to a great extent, but nevertheless some hand pick and shovel work must always be done also. There are a great many contractors doing this line of work for the reason that the work is generally very simple and it takes only a small equipment. What does this mean? It means that competition is keen and the prices for doing this class of work are well established. This makes the amount of work a contractor gets largely dependent upon how well he can determine what the real cost of excavating different kinds of materials should be, and to see that he gets it done for that price. In order to simplify the facts the writer will explain the point in question by taking for an illustration the excavating of a sewer line which was excavated entirely by hand. Let us consider how the materials to be excavated are generally classified. They are generally classified as loam, sand, gravel, clay, hard pan, rock, etc. No distinction is made as to the proportions in which the materials are mixed, or whether a material is hard to remove, like cemented gravel, or easy to remove like gravel containing a large percentage of fine sand. All these conditions, however, affect the cost to such a great extent that it seems strange that stress has not been directed along these lines before.

This problem of classifying materials on excavation work came up in connection with the adoption of scientific management for a large land development company in the South, of which the writer had charge. In order to properly "route" the work of installing the sewer lines, it was necessary to determine accurately the amount of time required to excavate the trench to lay the pipe, and to backfill the trench. "Routing" the work means the planning out ahead of time, on paper, of every detail, and developing instructions, stating exactly how this work is to be carried on and the time it should take to do the job. In other words, a job is minutely analyzed and every detail is pre-determined. To do this, exact data had to be obtained through "time study." These time studies give a true basis for comparing the work of one gang with the work of another gang, they give a comparison between the work of individual men in the same gang, and they also give a more accurate method for estimating purposes than can be obtained in any other way. Setting rates by time studies, if properly done, is a scientific and correct method of determining the proper time for doing the work, differing from the ordinary way of setting piece work rates which are based on the personal judgment of the foreman or superintendent as to the time it should take. The subject of time study work will not be taken up in detail in the present article.

Let us digress a little from the topic in hand in order to bring out a few points which have important bearing on this proposition of studying the work in detail and determining the amount of time required to perform each operation. The first point is, can the present records which are kept of the finished work be used accurately to determine what future work should cost? The second point is, of what value would it be to the executive engineer of a construction company to know what the work was costing day by day and get this report on the following day?

Records Generally Crude

Taking up the first point, we find that the records of most construction companies who do excavation work are very crude in that they omit to have recorded, or even sent in from the job, daily records of every condition which affects the cost of doing the work. The records on the books will show the work done under one foreman varying by as much as 500 per cent. or more, without giving any adequate reasons for same. Sometimes a brief description may be recorded stating that 25 per cent. of the material was rock and that water was encountered, but it fails to state whether the rock was blasted out, whether the water was sufficiently great to require pumps or what not. When this foreman is called into the office, he generally can satisfy every one as to the reasons for a high or low cost, for he remembers the conditions on the various jobs which were troublesome and probably costly and enlarges or diminishes the extent of the trouble according to whether he is accounting for a high or low cost. The storing of the information of the jobs in the heads of the various foremen is a very bad practice, for it not only is not available to the proper party, but it becomes distorted and even dangerous to use unless the party using it takes into consideration the foreman who is giving the information.

A discussion of the second point, namely, of what value would it be to the executive engineer to know what the work was costing day by day and to get a cost report on the following day, involves a consideration of the following question: Can any engineer after a job is finished give good, accurate reasons why the cost of one day's work sometimes costs double that of some other day's work? Was the foreman inefficient, was it due to exceptionally bad material, was it due to ground water or rain washing in the banks, or was it due to a combination of several or all of these causes? It is impossible for any one to state definitely the real cause, for after a job is finished it is impossible to remember all details. The construction engineer needs to know whether or not the men are producing a good day's output, and that the foreman is competent or not, from day to day. If this is possible, then an in-

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By W. O. Lichtner, in Engineering and Contracting.

efficient workman or foreman will not be kept on indefinitely, but will be held accountable for each day's work and he cannot get along many days before being found out. If a company had a means of determining this, could they afford to pay the man and foreman a bonus? Actual figures show that the work in one case which was conducted on a task and bonus system was performed 50 per cent. cheaper than previous work of the same character, and this figure takes into consideration the extra money paid to the men in the form of a bonus. Many other cases of a similar character could be cited. What does this mean? It means more money to the men; it means cheaper work for the company, and places the company in a position to know actually what the work is worth.

Returning again to the topic in hand, we found at first some of the officers of the company were very much opposed to the taking of the time studies, for they could not see, in the first place, how it was possible to take the studies, and in the second place, they didn't believe that the time values could be used after they were all developed on account of the great variation in the character of the materials encountered. There are probably only a few places in this country where so many different kinds of materials will be encountered as was found in this one locality. The materials differed in composition, varying from a fine quicksand, which virtually boiled up from the bottom of the trench and ran through joints in the sheeting, although it was closely sheeted, to a very tenacious stiff clay, and also to boulders and solid rock which had to be blasted. These varying materials were not in different localities, but were encountered in a trench 600 ft. long.

In taking time studies the time study man made his observations in the usual manner and classified the materials according to the materials encountered, calling them by their names—sand, clay, gravel, etc. This seemed satisfactory until we started to work up the notes, when it was found that with all the conditions being identical as far as could be determined, that is, having the same man, the same tools, the same weather conditions, and what was thought to be the same materials, the times per cubic yard for excavating would vary termendously. This variation then must be due to a slight difference in the materials. To determine this, samples were taken of every kind of material, and as it was removed from a trench, each sample was placed immediately in a glass quart jar, sealed up, and taken to the office for further study. This study resulted in getting up a symbol list for designating the materials, so that the men in making out their reports could indicate the materials by a letter or symbol instead of using a long description, using, for instance, MC for medium clay, DS for dry sand, etc. More time studies were taken and worked up and compared with the previous ones taken to see if we could determine the time it should take for each of these items. This was tried out for a short time and the classification found unsatisfactory also, for there was some element which was defying us in some way. We found that a medium clay, for instance, could be excavated in one case with comparative ease, while in another case it was hard to get out. Upon closer inspection of the first sample, we noted that it contained mica, while the other hard sample did not seem to contain as much as the first one, so it seemed possible that the kind of material of which it was composed was the determining factor in the case.

The various samples of materials which had been gathered in the mason jars were submitted to a number of geologists for analysis as to the geological composition of each of the samples. After an exhaustive study by these men we found that no geological separation was possible. This problem, like a number of other problems we have had to deal with in taking time studies, was one which at the start looked extremely simple, but which in reality had an element in it which never had been brought out by any one and probably never could have been brought out excepting by a detailed study of the whole problem with a view to determining the exact time of doing each part. This proposition was therefore studied further with the result that we noted that different materials of entirely different composition sometimes broke up under the pick in the same way, while similar materials did not, if they contained different percentages of water or if mixed with carrying percentages of other materials. This same fact was noted to hold with the shovelling operations. For instance, a rotten rock was picked with difficulty, but it broke up into fine particles, so that it piled up high on a shovel and shoveled as easily as a fine moist sand or cinders. New studies were then taken, using this as a basis, and it was evident from the first studies now taken that the correct solution of the problem had been found.

Satisfactory Classification

From the new time studies a new classification was made, basing the times on two variables, first, on the time it takes to pick the material, and secondly on the time it takes to shovel the material after it is picked. The material to be excavated then would be designated by two capital letters like BA. The first letter always designated the picking element and the second letter the shovelling element. By time studies the amount of time it would take a man to pick one cubic foot of material was determined and classified as B picking; also a time per cubic foot was determined for C picking, etc. In a similar manner, time per cubic foot was determined for all kinds of shovelling. The picking classification, which was always the first letter and always made with a capital, was as follows:

A—No picking required.

B—Loosens uniformly into fine material, with no appreciable lumps, and picks easily.

C—Loosens easily into its component parts like a non-homogeneous material, as gravel mixed with sand, clay, or loam. Gravel less than 50 per cent. and not large.

D—Same as B except pick does not enter readily.

E—Loosens into lumps like a homogeneous material, not as hard as J.

F—Loosens hard into component parts like a non-homogeneous material as a cemented gravel.

G—Loosens into lumps and picks hard like a homogeneous material which is brittle.

H—Loosens into lumps. Material very tenacious.

I—Loosens into large lumps with very little fine.

J—Loosens hard on account of pick striking stones.

K—Loosening small boulders in trench (1 man size).

L—Loosening large boulders in trench.

M—Sledging rock.

The shovelling classification, which was always the second letter and always made with a capital, was as follows:

*A—Finely divided material which heaps up on shovel.

B—Finely divided material which does not heap up on shovel.

C—Lumpy and fine material mixed.

D—Loose material like sand, clay, or loam, mixed with small gravel.

E—Same as D except large gravel.

F—Finely divided material. Can be spaded easily and requires no picking.

G—Supersaturated clay which can be shovelled.

H—Supersaturated clay which must be baled out in buckets.

I—Supersaturated material with small boulders which is baled out in buckets.

J—Sticky material which adheres to shovel.

K—Large lumpy material which averages 1 to 2 lumps per shovel.

L—Lifting small boulders from trench (1 man size).

M—Lifting large boulders from trench.

This classification has been used with great success for some time now and is a most satisfactory classification for practical purposes. The determination of the time for each one of these items is a matter of time study which can be readily accomplished. Studies will have to be made, of course, to take care of the great number of variables, and tables compiled accordingly. We were able to utilize the information which came into the office daily, due to the "routing" of the work, and this saved one taking a great many time studies, which also meant quite a large saving in expense.

The major part of the time studies were made by Mr. Frank A. Baker, one of our engineers, who deserves great credit for the manner in which he co-operated with the writer in this work.

Treatment of Worn Out and Ravelled Macadam Surfaces[*]

By Col. Edmund A. Stevens[†]

BEFORE discussing the cure it is well to define the trouble, and to analyze its causes. The word ravelling is used rather loosely. For my purpose I shall consider it as the loosening of the bond of a road surface until the macadam stone lies loose and free on the road. By macadam stone, I mean, not the small stone used to fill voids and give a smooth finish to the surface, but the stone that constitutes the body of the road's surface. In macadam work this stone when compressed to its final form occupies about sixty per cent. of the volume of the road surface. The forty per cent. of voids is filled in varying proportions with surface stone, screenings, stone dust, sand, earthy materials and any chemical binder used to "hold the road." The mixture of fine stone, sand and earth filling the voids has no appreciable tensile strength. Its duty is to wedge the macadam stone in place and prevent internal movement. Such a structure is called on to carry loads, to receive and absorb propelling thrusts. The road should be of sufficient depth to transfer the stresses thus imposed to the sub-base without serious internal movement and at unit pressures less than the resisting power of the soil. It is thus subjected to vertical and horizontal forces that contribute largely to ravelling.

Let us briefly consider these.

A draft horse weighing 1,200 lbs. will have all his weight at one time on two feet. He will exert say one horse power at a speed of four miles. The vertical force at the foot is 600 lbs., the horizontal $\frac{23,000}{2 \times 4 \times 88} =$ 47 lbs. These forces are or may well be concentrated on a toe calk two inches in width; the resultant force slightly exceeding 300 lbs. per linear inch.

A motor truck weighing, loaded, 16,000 lbs. and exerting at the wheel runs say 30 h.p. at 10 miles an hour, will with 60 per cent. of load on rear axle, exert a vertical force of 4,800 lbs. and a horizontal of 562.5 lbs. at each rear rim, the resultant being about 800 lbs. per lineal inch for six inch tire.

For a pleasure car weighing 4,000 lbs. with 60 per cent. of weight on rear axle and exerting 40 h.p. at the wheel rims with a speed of 35 miles, the vertical force at each wheel is 1,200 and the horizontal 214. The resultant is about 400 per linear inch for a bearing width of 3 inches.

At curves with high speed cars, the horizontal force is considerably increased, for it is impossible to so "bank" a curve as to suit the speed of all classes of traffic.

In the case of wheels transmitting vertical loads only, observation indicates but little dust raising from a road not overlaid with loose dust. Such a wheel will at the point of mathematical tangency have no velocity relative to the road; a vertical velocity is imparted to it and as any section leaves the surface it will raise with it any of the lighter particles that are loose and may come into contact with it. At the driving wheel there is a slight slip which in addition to lifting will throw particles backwards.

These are the forces tearing at the road surface. In some cases they are more than the road can stand. The horse's calk acts somewhat like a chisel. It will pry out the binding material between the stones as well as the latter themselves when the bond is weakened. The driving wheels of motor vehicles push or suck any material thus loosened out of place. The binder loses weight as it parts with moisture; besides this, without moisture it also loses, not only its property of recementing itself under pressure but to a great extent, its binding power as well. The real work of transmitting the stresses due to traffic must be borne by the stone. These are merely held in place by the binder. The latter is gouged out by the horse, drawn or pushed out by the automobile tire, blown away by the wind, or washed off by the rain and a loosening of the upper stone results.

Even on a well consolidated road climate stresses impose a heavy duty. If, however, there be voids the risk of failure increases. Voids may be due to deficient rolling or to the rise of too much clay in the earthy binder. Lumps of this material will bridge the space between stones even under hard rolling. The bridge will break down eventually either from pressure or moisture or a combination of them. A void forms where the bridge was and continues rising until near the surface when ravelling results. The same may be true in the cases of too light rolling.

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[*] Read at American Road Congress, Detroit, Mich., Sept. 29--Oct. 4, 1913.

[†] State Highway Commissioner of New Jersey.

When bituminous material is used as binder it is liable to disintegration from weathering, from overheating or from admixture of earthy materials.

An ordinary water bound macadam may lose material by wear up to a thickness of about half an inch a year without being overloaded. The thickness that can thus be lost will vary with conditions, one of which probably is the ratio of the maximum wheel load to the total tonnage borne by the road.

Whatever the rate of waste it must be replaced if the road is to be maintained.

To summarize the foregoing:—

Road ravel from;

1. Improper construction.
2. Overload.
3. Neglect.

In all cases these affect the binder.

Poor workmanship in construction can only be cured by remedying the original defects. These generally show themselves by small local depressions in the surface from which ravelling spreads, in certain cases at an almost incredible speed. In bituminous surface faulty material and thin spots generally show up clearly. In both cases the only remedy is to rebuild the work properly, if necessary, from the subbase up. This is not strictly repair work.

Effect of Overloading and Neglect

In considering the effect of overloading and neglect it must be borne in mind that any given type of construction may be so maintained as to vastly increase its carrying capacity. The problem is largely one of economics and administration. As an illustration, assume in two cases the same foundation—let one road have a water bound macadam surface dressed with a heavy bitumen forming a sheet about one-half inch in thickness and the other a bituminous concrete (mixed method) surface of say two inches. The former will cost about 40 cents for stone and 15 cents for dressing, or 55 cents per square yard, and the latter about $1 (both exclusive of the foundation). With proper care the lighter surface will last about three years under fairly heavy traffic, the heavier one an unknown period, but let us assume twelve years. The total yearly charges against the two may then be stated about as

The fixed charges are 7.2c against 12.3c.

The operating charges 6.8c against 1.7c.

I do not claim that these figures are more than illustrations of the principle involved. They show a great saving in operating charges, those that show up in the yearly tax bill. The fixed charges, however, are just as real and must be met at some date.

For a road with 9,500 sq. yds. per mile the costs as shown in yearly tax charges where depreciation and interest are not visible, would in this case be,

For the dressed macadam, per mile . . .$636.50
For the Bituminous Concrete 161.50

yet as shown above the real cost of the two roads is the same. This case affects our subject because the treatment of a ravelled road surface must depend on the system of maintenance.

In most communities the great consideration is the next yearly tax bill. If that can be kept down for a period the ultimate economy of such a policy receives but slight attention. It is generally easier to get money for a new road than for repairs. A road requiring a large yearly repair charge is condemned without a hearing. The road calling for heavy interest and depreciation charges may be an equally or even more expensive solution; but the interest charge is not so apparent and the depreciation charge is not made. This is simply putting off the day of reckoning which is sure to come. However, the troubles of those in charge ten years hence are usually lightly borne by the officials of today.

If we consider the structure of the road surface we can easily see that the 40 per cent. of voids in the macadam stone will be filled somewhat as follows:—

Surface stone, passing 1-in. ring and caught on ½-in. ring . . . . 15% to 20%
Screenings, passing ½-in. ring . . . . . 15% to 10%

The other 10 per cent. should be composed of sand and clay.

When dry the clay is driven off to a greater or less extent as dust washed away or splashed off as mud. Its place is supplied to some extent by detritus the result of the wear of the larger and heavier materials. These also blow or wash away and the road loses its bond. If our road is not overloaded we can retain its usefulness by making good its losses, with proper materials in their needed proportion. It is here that the trained road man is most needed. Nothing can replace his experienced judgment.

In the case of a ravelled road having first determined that the road was well built we must decide whether the traffic is too great for the type of surface, or whether the failure was due to neglect. If the former we must resurface with some better type. If the latter we can repair the old surface.

Resurfacing should always be preceded by scarifying and by bringing the road up to the necessary depth of stone. For water bound macadam needing greater surface strength several classes of chemical binder may be used of which I shall discuss two, bitumen and lignin.

Application of Bitumen

The bitumen may be applied either by penetration or mixing methods. The former is the cheaper, the latter the more trustworthy. Which method is to be used will after consideration of the care the road will receive depend on the estimate of the overload, as will also the depth of the bituminous sheet. My own observation leads me to question the wisdom of attempting to get any thickness exceeding one-half inch by penetration methods. It also leads me for this class of work to prefer tar to asphalt. The former material appears less sensitive to injury by dirt and to yield better results in repair work.

The lignin binders are derived from the waste products of wood pulp or tannin manufacture. There are cements being also used to bind core sand in foundry work and impart a tensile strength to the binding materials. They will not act on materials soaked in the so-called road oils. The action of some of these materials on slag and red shale is quite remarkable. They are slightly soluble in water and will therefore need renewal. Their application, however, is easy and inexpensive and the effect of successive applications seems cumulative, increasing not only the depth of penetration but the strength of the bond. The waterproofing of lignin bound roads with bituminous tops has been carried out in Connecticut but I am unable to give any facts as to the results.

For water bound macadam roads that have failed through neglect a thin coat of gravel carrying some earthy matter or of screenings or coarse sand mixed with earth will usually cure cases that have not gone too far. In some of the counties of New Jersey it is usual to fill all ruts, depressions, etc., with fine stone and to give the middle of the road a coat of the same mixed with a little clay. Much of this material is wasted by being thrown off the road by the traffic, and the old ruts almost invariably reappear. This method, however, is very successful in preventing ravelling. It seems a false economy to omit rolling and wet rolling, at that. The same is true of patching holes with anything but macadam size stone. The roads treated with small stone are yearly losing depth. The moisture for wet rolling is usually bountifully supplied by nature, in the early spring. It can also be had by the use of hygroscopic salts where water is hard to get. Traffic will usually throw off from the road surface enough stone to pay for rolling.

A treatment of clay, without rolling, will often give astonishing results. Such treatment, however, seems only a palliative not a cure. Roads thus treated become dusty or muddy according to the weather, show a tendency to ravel again and are hard to properly treat with bitumens. They will, however, take the lignin binders with good results, if the dose of clay has not been excessive, or if the excess is swept off before treatment.

In closing a word of warning as to the use of the so-called cold oils may not be out of place. Those of the so-called non-asphaltic class, to a greater extent than the so-called light asphaltic oils, seem to act as lubricant on road materials and to foster pot holes, ravelling, and other failures. It may be possible to properly apply these materials but if so it is rarely done. It is certain that even slight depressions will cause a deep penetration of the road. The dust laying qualities of the material thus absorbed are lost and its lubricating effect given the best possible conditions to get in its pernicious work. Local authorities and even private individuals seem to select roads with uneven surfaces as those on which to use these oils.

The Investigation of Existing Engineering Structures

By Horace R. Thayer

PROBABLY no more difficult, unpleasant or thankless task confronts an engineer than the examination and report on a structure of doubtful safety. The first step in such an undertaking is to obtain the complete dimensions, cross-sections and details of the entire structure. Sometimes these data may be found on the contract plans. There must be used with very great care, however, as it is rare that some changes are not made either at time of erection or in subsequent use.

The character of the material may appear on plans or in the records. Several pieces may be cut out to be tested, or perhaps a visual examination will determine a good deal. The former is the approved method of ascertaining if steel has been injured by fire or accident, while the latter might be of assistance in the case of wood or cast iron. It is extremely important to note the deterioration caused by rot, rust and wear due to traffic. One trouble with steel is that its overload is hard to detect by an examination unless stresses exceed the elastic limit. Workmanship must be determined by eye.

Finally, we must estimate live loads, compute maximum unit stresses in weakest part of each member, and compare results with those allowable by some standard specifications. Before rendering a definite decision, we should consider:

(1) What possibility is there of an increase of loads during future life of the structure? It is quite possible that it might be all right for present conditions but without reserve capacity. In this case the structure should be passed conditionally.

(2) Would some special weakness exist under extraordinary loads? It may be wise to strengthen that part for the sake of the additional security.

(3) Secondary stresses need not be included for designs in accordance with modern practice. But for long members and eccentric loads secondary stresses should be computed, especially for columns. If found to be excessive, say above 15 per cent. of the principal stress, a corresponding reduction in allowable principal stress must be made. We believe that the present tendency is toward the much more logical method of computing secondary stresses and increasing in a like ratio allowable value.

(4) Assistance of parts other than those usually taken as carrying the load, is to be assumed with a great deal of caution. For example,, rails, guard rails, and guard timbers will do much to assist a short, weak I-beam span; but if they are to be figured on, splices must be watched and the trackmen prevented from pulling them up for repairs at a time when the full load is coming on.

(5) Standard specifications have been evolved as a result of the failures and successes of the past and may generally be taken as a safe and dependable guide. For example, the usual clause prohibiting welded joints for members other than counters and wind laterals is to prevent accidents like that of Bussey Bridge.

(6) Particularly to be emphasized are the following points:

(a) Precautions to avoid possible loss of life by fire in a building. Not only should the steelwork be protected as specified, but guard as well against inter-room communication and the exposure to fire.

(b) Provision for wind pressures all the way through the structure.

(c) Fastenings of each part so that its separation from the remainder can be accomplished only by the rupture of the fastening.

(d) Support of long compression members at frequent intervals.

(e) Thorough bracing, especially in localities where high winds or earthquakes may be expected.

(7) It might seem that the margin between an ultimate strength of 60,000 lb. per sq. in. and an allowable

value of 16,000 lb. per sq. in. such as is employed in buildings, is excessive. First, however, let us consider that the structure would be ruined by 35,000 lb. per sq. in., or more probably 25,000, for practical conditions with full-sized pieces. When we come to consider eccentric stresses, overloads, etc., we find our margin nearly exhausted.

As a general rule we suggest:

For good designs allow 10 per cent. excess of stress above specifications; 10 to 20 per cent. overload should receive constant watching; 20 to 40 per cent. is dangerous; above 40 per cent. the structure must be replaced at once.

For poor designs, compute secondary stresses and permit totals to exceed above percentage values by 15. For worn, corroded or injured material, estimate or determine by testing, its strength as a percentage of its original strength, care being taken not to overestimate. Original allowable values multiplied by the percentage give our standards for the particular case.

The Government Dry Dock at Levis

The new dry dock which is to be built by the Dominion government on the St. Lawrence River, near Levis, across the river from the city of Quebec, will have the following dimensions: length from caisson stop to head wall, 1,150 ft.; width of entrance, 120 ft.; depth on sill at ordinary high water, 40 ft. It will be divided in two parts, 650 and 500 ft. respectively, the outer entrance will be closed by a steel rolling caisson, and a floating caisson will close the inner entrance. The dock will be emptied by three electrically driven centrifugal pumps, each having a capacity of 60,000 gal. per min., the current being furnished by three turbo-generators.

The design and construction are under the direction of the Department of Public Works, Eugene D. Lafleur, Chief Engineer, and E. A. Hoare, of Quebec, has been appointed to supervise the execution of the work.

The Levis dock will be when completed the largest dry dock in the world, slightly larger than the present design of the new dry dock under consideration for the port of Boston. This latter dock will be of the size noted in the following table showing the three largest dry docks, one completed, one under construction and one under design:

Contraction and Expansion of Cement and Concrete

Dr. P. Rohland, in a recent issue of Mitteilungen der Centralstelle, has summarized the phenomena of expansion and contraction of cement and concrete as follows: If concrete and reinforced concrete set in the air, contraction takes place; if they set under water, expansion takes place. The latter is true if concrete sets in very damp air. Mixing more sand, or else adding hydroscopic salts decreases contraction. Another method to avoid excessive contraction is to cover the concrete with wet cloths.

If cement is mixed with water, elements in the colloidal state separate, which absorb water and lead to an increase in volume, accompanied by a slight lowering in temperature. As the cement begins to set, the volume gradually decreases, while the temperature increases. The cause of this decrease in volume and increase of temperature is the sudden coagulation of the colloidal elements in the cement which occurs with separation of water.

We have, then, two distinct steps: 1. Absorption of water with increase of volume and decrease of temperature; 2. Separation of water with decrease of volume and increase of temperature. It must be mentioned that the increase of volume in the first period is greater than the decrease in the second period. At the end of the setting process in cement and concrete a considerable decrease of volume takes place, for which allowances must be made, especially if the concrete sets in dry air.

Boring for the Simplon Tunnel

According to our London contemporary, The Engineer, the boring of the second gallery of the Simplon Tunnel is advancing steadily, 1,367 workmen being employed in the tunnel itself and 816 outside it—in all on an average 2,183 per day. The work is in the hands of the Swiss Federal Railways, and is being supervised by Chief Engineer Rothpletz, who was also the chief engineer of the Lotschberg Tunnel. Originally there was talk of handing over the contract for the work to a German firm, whose tender was lower than that of any Swiss firm, but owing to the outcry raised by the Swiss engineers, and more or less by the Swiss in general, the Federal Railways decided to be its own contractor. The total length of the second Simplon Tunnel is 12 miles 555 yards. The length of the completed shaft at the end of last July amounted to 995 yards on the north or Brigue side, and 1,777 yards on the south side. The work advanced during July at the rate of 286 m. on the south and 273 m. on the north side. Of the whole tunnel 11.2 per cent. was completely blasted out at the end of July. So far, no special difficulties have been encountered, and the temperature is as yet not at all unbearable. Great precautions are being taken to ensure the safety of the original tunnel, which it is now recognized ought to have been at a somewhat greater distance from the second gallery.

Rather a striking piece of reconstruction work has been accomplished in Tuscarawas County, Ohio. During the recent floods many bridges were destroyed in this county. One stone pier, however, was found to be intact, but badly settled on one side. The foundations had been laid in the river bed, in 16 feet of water. A diver was employed, who, upon examination, discovered that the pier was resting uniformly upon a bed of gravel. Instead of removing the entire pier, as is usual, the upper part only was removed to a plane 24 inches below the surface. Piles were then driven in around the remaining part; and on these piles a new foundation, over and around the old one, was constructed, and upon this the material of the old pier was reset. Neither cofferdam nor excavation was necessary, as a tight foundation form properly braced contained the concrete which was deposited under the water. The method proved both effective and cheap.

Three hundred men are at work on the new 18,000,000 gallon reservoir being constructed by the city of Winnipeg on Logan avenue, west of McPhillips street, which is being rushed to completion. It is a great hollow structure, and has taken 13,000 cubic yards of concrete and 600 tons of steel rods to complete. Over 600,000 feet of lumber have been used to make the concrete forms. The reservoir will hold three days' supply of water and will be completed by November 1st. The structure is 570 feet long, 460 feet wide and 15 feet high, and will cost $100,000.

Engineering Topics in the Old Land

London Correspondent of the Contract Record Commends Canadian System of Registration and Discusses "Professional Unions"

WITH a view to bringing the constructional interests of Canada more closely in touch with the Old Land and also with a view to setting forth such examples on either side as may be profitable the one to the other, we have completed arrangements with a well-known engineering authority in London, England, to contribute articles dealing with matters of current interest, and particularly with such subjects as may have an international bearing. It is hoped that readers of the Contract Record will show their interest in these articles, which will appear once a month, by contributing letters dealing with the topics under discussion.

The letter published this week deals with two very interesting subjects, the conditions surrounding which find a ready parallel in this country, although from the instances mentioned we are reminded of what the surveyors have accomplished in the way of closing their profession in Canada.

Under the heading, "Professional Unions," our correspondent makes a few observations which are particularly timely in view of the fact that a Canadian Society of Municipal Engineers is now in sight. It comes as a bit of a shock to us who have espoused the cause of such a distinctive society to learn that in England, where there are two such institutions, things are no better than they are in Canada. As to whether it is fair to draw conclusions from this and apply them to Canada is a matter that might well engage our readers in the task of a letter for publication.

London, Eng., September 27, 1913.

The registration of engineers, architects and surveyors is a matter which has been exercising the minds of professional men in this country for several years now. As things stand, anyone may practise in any or all of the professions. No qualification whatever is needed, and it is quite understood that a swagger office and a motor car are more profitable assets than education and technical knowledge.

The ignorance of some, even of the biggest, men in the profession is simply appalling, and many of them depend entirely upon their assistants to carry out the huge jobs that are entrusted to them. Ghosts and jackals, living on the shillings thrown to them by their guinea-earning brethren, abound, and it is among these that the real talent exists. An architect who is now top of the tree in his profession "devilled" for years for firms of auctioneers and estate agents, who, owing to the lack of registration, called themselves also "architects and surveyors." A ghost who is a personal friend of the writer prepared a rough scheme, with estimate and sketch plan, of a large system of tube railways, receiving as his fee a sum of less than twenty guineas! What the engineer who sweated the job out to him obtained for his report, based largely upon the rough scheme, it is not possible to say, but the twenty guineas could well have been squared and then trebled in his case.

Instances such as these, incredible as they may seem, could be multiplied indefinitely. Registration would at least mean qualification of a sort (when the present generation had been weeded out) and the brainy individual would then be given some slight opportunity of coming into his own.

As things are now, numbers of able men are leaving the country to seek for those better opportunities which the Colonies afford, and if they don't find exactly a bed of roses they can (given grit and persistency) at least earn a decent living.

It is quite as well, however, to know the conditions of a country before deciding to emigrate. One of these "able men" who has just returned from Alberta writes: "I then decided to go into real estate and surveying. Unfortunately I found that I could not obtain a surveyor's license to enable me to practise as a surveyor, until I had served twelve months' articles with an Albertan land surveyor."

Another found that there were similar restrictions in British Columbia. He writes: "One cannot subdivide property or make a survey of any description to be put on record unless one is a British Columbia land surveyor, and to get this diploma one has to be articled to a British Columbia land surveyor for a period of three years and take two examinations." Something of the kind here in England is sorely needed, if the nails of the incompetents are to be cut and the men of ability enabled to scratch around for a decent living of their own.

Professional "Unions"

In municipal engineering things are no better, in spite of the existence of two institutions representative of the profession, and the fact that both of them hold periodical examinations and confer degrees. Local authorities are utterly supine, and neither membership nor qualifications count for anything in their eyes. Many appointments are political or avuncular, while the local favorite is always very strong in the running. There are scores of men holding really responsible positions who can neither write nor speak their own language correctly, while the less said about their technical qualifications the better. The natural result of this is that the municipal engineer cannot call his soul his own. His office is entirely unprotected. He is at the absolute mercy of his council. Except in the very largest cities no scheme of superannuation exists, and his tenure of office is often only from mouth to mouth. The wonder is that there are as many good men as there are.

It will be asked, what are the institutions doing? And there can be but one reply: Nothing. The municipal engineer has a horror of the word "combination," savouring as it does of "union," and any reference to trade unionism is taboo in his society. He has not the acumen to recognize that the State-protected professions of law and medicine are the strongest of unions. It is strange to think of some thousands of men, holding responsible posts, spending annually millions of public money, and yet, simply owing to an unreasoning pride, bowing their necks in slavery, suffering untold indignities and receiving (as regards the large majority) a wage that would be scorned by the union bricklayer.

It is to be hoped that any Canadian institution of municipal engineers that may be formed will work upon "union" lines, with the sole proviso that the word union be taken in its best sense and not merely as an aggregation of units bonded together for the purpose of taking all they can get and conceding as little as possible in return—**B.W.**

The West Vancouver Ferry Company has asked the council at that place to bring in a by-law for the construction of a wharf at Dunderave at a cost of $40,000.

Tests of Road Materials

Third International Road Congress

FIVE reports were submitted to the congress on the subject of communication No. 2, "Tests of Materials Used in the Construction of Macadamised Roads." In the British and the American Reports the apparatus used for physical tests of road stones is described and illustrated, the British report including a two-page table showing the results of tests. There is a similar table, giving maximum and minimum values for twenty-seven kinds of stone, in the American report, which runs to twenty-six pages of text and illustrations together, the apparatus being very carefully described and discussed. The French report is a useful summary of tests usually employed, including tests for aggregate materials and mixtures. The Austrian report is mainly a comparison between the wear of stones on the grindstone and that with the sand blast. The German report includes a description of the methods employed in testing samples of road crust taken from the roads, special attention being given to absorption and freezing tests. A few of the most important of the facts reported and opinions expressed are briefly noted below.

GERMANY

Dr. J. Hirschwald, Professor, Technical High School, Berlin-Charlottenburg

The report describes the methods employed at the Mineralogical and Geological Institute of the Royal Technical High School, Berlin, and reference is made to the reporter's work, "Handbuch der Bautechnischen Gesteinsprufung." The investigations into the condition of crusts after they have been in service include studies of chemical combinations. "Experience shows that the good quality of road-surfacing material, above all, depends on the strength and toughness of the stone." Since water expands about one-tenth of its volume on freezing, absorption up to 90 per cent. of saturation is harmless even with very weak stones, but the strongest stones burst on freezing if nearly saturated. This has been proved, experimentally, with many samples.

AUSTRIA

Prof. A. Hanisch, K.K. Oberbaurat, Vienna

In the grindstone test the load is 30 kilogrammes on 50 square centimetres for 440 turns, radius of stone 25 centimetres, 20 grains of Naxos emery No. 3 for every twenty-two turns, the sample twisted through 90 deg. during each revolution of the stone. The sand-blast test is on a cube or plate of 7 cm. edge, the blast pressure being four atmospheres, and the exposed surface a circle of 6 cm. diameter.

A number of samples of basalt showed considerably greater wear in the grindstone test—3.8 to 4.5, 5.7 to 9.5, 7.3 to 8.5, and one sample showed equal wear, 9.8. Granites usually showed less wear on the grindstone—8.1 to 6.0, 8.3 to 7.1, 9.8 to 8.7, 10.2 to 6.7, and so on—but sometimes greater wear on the grindstone—6.0 to 6.9, 6.6 to 7.8—the wear under the sand-blast being much the more variable. Close-grained limestone showed much more wear on the grindstone—8.1 to 23.1, 9.8 to 41.9, 14.5 to 25.1, 15.1 to 21.6 (sand-blast to grindstone). A silicious limestone gave 4.8 to 3.4, and a quartzite 9.9 to 5.8. One sandstone gave less on the grindstone—20.9 to 17.9—but two others 26.2 to 33.7 and 28.3 to 47.9 A hornblende gneiss gave 19.6 to 9.2.

UNITED STATES

L. W. Page, Director United States Office of Public Roads

The reporter's discussions of the values of different tests, and of the relations between one test and another, cannot properly be summarised in a brief and yet intelligible manner, but attention may be directed to the following passages:—

"Investigations . . . seem to indicate that the cementing value depends on certain hydrated colloidal conditions of the particles. All rocks that cement well are hydrated—i.e., contain water of combination—although it does not follow that all hydrated rock powders will cement. It seems that only a certain kind of water of combination is concerned with and measures the cementing value." [There follows a description of a ball mill devised for the testing of the cementing value of rock powders.]

" . . . there is no very definite relation between the Dorry test and the Deval test. . . . There seems to be a more definite relation between the toughness and the percentage of wear for high values of toughness, so that the results of the Deval abrasion test are probably more dependent on the toughness than on the hardness."

"Certainly the hardness test alone is of no value, since the rock might be hard but be entirely lacking in toughness, as evinced by some of the quartzites and sandstones. . . . The toughness test, on the other hand, if satisfactorily passed, would likewise assure a compliance with the hardness requirements. Some form of toughness test, then, seems to be the logical one for testing rocks for road building, whether it be of the Deval abrasion type or some convenient form of the pure impact type. There is much to be said both for and against the Deval abrasion and the impact test."

"The Dorry hardness test, in its present form, is one which requires a good deal of care in order to obtain reliable results."

FRANCE

P. Le Gavrian, Ingenieur des Ponts et Chaussees, Secretary of the Research Commission of the Ministry of Public Works

As regards the Deval apparatus the reporter writes: "It would, perhaps, be of interest to modify the apparatus, for example, by constructing the cylinder with a double tube, the interior envelope being pierced with holes to act as separator sieve for the dust."

"The Dorry mill has some disadvantages [attention is drawn to these as noted by Mr. Page] . . . For this reason at the Laboratory of the City of Paris the substitution of the Dorry machine by a machine giving a cylindrical wear of uniform character has been quite recently thought out. The following is a brief description of this apparatus: A cast-iron drum of 0.60 metres (about 2 ft.) in diameter turns about a horizontal axis; the test pieces are placed in shutter boxes sliding in sockets and supported on the upper surface of the drum on the cylinder; these are two calibrated funnels which allow from the one powdered sandstone and from the other water to flow on to the contact surfaces. A few preliminary revolutions of the apparatus are sufficient to give to the lower face of the sample an initial curve, fitting the surface of the drum exactly; then the height of the sample is measured. This measurement is again taken at the end of the experiment."

Tests of the Point of Fusion of Bituminous Materials.— "The simple result of these methods [a number of which are described] shows how greatly the determination of the point of fusion of materials of pasty nature is subject to variations according to the method adopted, and, with a certain [? a given] method, according to the person who uses it."

THE UNITED KINGDOM

T. E. Stanton and R. G. Batson, of the National Physical Laboratory, Teddington

The machines described are the following: The four-cylinder Deval machine, as used in the United States Office of Public Roads; the Page impact machine, with a 4.4-lb. hammer, acting through a plunger with a spherical surface 0.4 in. in diameter; the Dorry machine, speed twenty-eight revolutions per minute, repeated impact machine for the cementing test, after grinding of the materials in a ball mill and making the briquettes in a moulding machine.

A table of a full series of tests on fifty-one occasions is included in the report

Test on Three Sweeper Tuec Cleaner

The Engineering Department of Brown University, Providence, R.I., recently conducted an exhaustive test on a Tuec Air Cleaner, results of which are given below.

It is interesting to note the large volume of air given at the end of the hose. This volume would be amply sufficient to pick up any material able to enter the large tool openings or the large hose openings.

A Tuec Vacuum Cleaner (No. 600) was installed in the basement of a building in Providence and connected to suitable openings on the various floors by 3-inch risers to the fourth floor and by 2½-inch risers from there to the eighth. This machine was driven by a 5 h.p. d.c. motor designed to run at 3,500 r.p.m. All tools were attached to the wall openings by 25 feet of 1¾-inch hose.

With all openings closed and a voltage of 498, the motor ran at a speed of 3,416 r.p.m. and used 2.64 kw. Under this condition a vacuum of 2.7-in. was obtained at the machine.

With one floor tool open on the end of a 25 ft. length of hose, the motor used 3.28 kw.

With two floor tools on 25 ft. lengths of hose and one wall socket open, the motor used 5.02 kw.

The vacuum measured at the eighth floor, when all openings were closed was 2.65 inches.

With one 25 ft. length of hose and unequipped with tool, open, the vacuum was 2.5 inches.

With two 25 ft. lengths of hose, and unequipped with tools, open, the vacuum was 2.05 inches.

With three 25 ft. lengths of hose, unequipped with tools, open, the vacuum was 1.8 inches.

230 cu. ft. of air per minute was drawn through one length of open hose when all other openings were closed; 418 cu. ft. of air per minute was drawn through two lengths of open hose when all other openings were closed, and 567 cu. ft. of air per minute was drawn through three lengths of open hose when all other openings were closed.

Enquiries should be addressed to Mr. Jas. J. Martindale at the Canadian factory, 159-61 Richmond street west, Toronto.

Progress on Hydro-Electric Plant of Cedars Rapids Company

The Cedars Rapids Manufacturing & Power Company, which is constructing a very large hydro-electric power plant near Montreal, has issued a progress report showing the amount of work done up to August 23. Part of the work was done by the company but recently a contract for the other portion of the scheme was let to Fraser, Brace and Company. The Cedars Rapids Company is controlled by the Shawinigan Water and Power Company and the Montreal Light, Heat and Power Company. The report states that the following work has been completed: Rock excavation, other than stripping and trench work, 19.85 per cent.; rock excavation in trenches and ditches and stripping seats of bank, 59 per cent.; earth excavation other than stripping and trench work, 43.25 per cent.; earth excavation in trenches and ditches and stripping seats of banks, 36.20 per cent.; transporting and placing excavated rock in entrance works dam, .98 per cent.; transporting and placing excavated rock as stone protection, 1.54 per cent.; transporting and dumping excavated rock other than as per two preceding items, 54.40 per cent.; transporting and placing excavated rock in entrance works dam, .540 per cent.; transporting and placing other earth, 71.40 per cent.; for plain concrete in power house sub-structure, 15.70 per cent.

The report points out that when the canal is finished it will have its outer or south bank practically a straight line two miles long, and parallel thereto a similar bank located on the natural flow of the river, and at a distance from the south bank of about 1,200 feet. The width of the canal on the water line will be about 1,000 feet, and the total length of the canal from the ice fender above the Isle-aux-Vaches to the power house will be about 12,000 feet. Extending across the lower end of the canal and forming a dam, is the power house structure itself. This structure is of concrete, and in the power house is concentrated the total fall of 32 feet given by the difference of level between the top and bottom of the Cedars Rapids.

Several plants have been constructed during the past two or three years, using this single runner type of wheel with success. The units will be very different in appearance from the familiar Shawinigan units, or the smaller machines of the various power plants of the Montreal Light, Heat & Power Company.

The new Shawinigan wheels have a capacity of about twice the Cedars' wheels, but it must be borne in mind that the wheels at Shawinigan Falls are operating under a head of 150 feet, and the amount of water required to develop 20,000 horse-power under these conditions is about two-fifths of that required for the operation of the 10,000 horse-power units at Cedars.

On account of the low head and the available space it was impracticable to use a horizontal type of development. The wheels at Cedars will have a diameter of about 18 feet, and the generators will be about 35 feet in diameter.

The ice fender at the upper end of the canal will not take care of what is known at frazil ice, and special precautions are being taken to prevent interruption from this cause.

Very large units are not susceptible to the same trouble from this kind of ice as smaller units, and a very large amount of this ice will pass through the wheels as the openings through these wheels will be about 7 feet high and 3 feet wide.

As a preliminary to the enlargement of the Canadian canal at Sault Ste. Marie to a depth of 31 feet, the Government is arranging for the expropriation of Whitefish Island and an additional strip of land along the south side of the present canal. The actual work of enlarging the canal must wait until sanctioned by Parliament, but it is understood that a vote will be asked at the next session of Parliament for a preliminary survey and for the preparation of plans. The enlargement of the Soo Canal is a logical sequence to the enlargement of the Welland Canal. The next step will be the enlargement of the whole St. Lawrence canal system so as to give a continuous 30-foot channel right through from the head of the lakes to the Atlantic. This is the big scheme which Hon. Frank Cochrane is reported to have in view, and which the Government, it is said, will adopt. The formal announcement of the whole scheme will probably not be made for some considerable time yet, but meanwhile the enlargement of the Welland and the Soo Canals will be proceeded with.

Mr. W. H. Wheeler, formerly assistant city architect, has been commissioned by the city council of Edmonton to prepare the specifications for the public market building to be erected in First street at a cost of $80,000. It is announced that tenders will be called for at once, so that the work may begin without delay.

Methods of Bituminous Construction*

The Penetration Method as Specified by the Pennsylvania State Highway Department—Selection of Materials Governing Factor

By S. D. Foster†

THE subject of bituminous construction is such a broad one, and one upon which so much has been said and written, that I will not attempt to discuss its merits, compare it with other types of pavements, or take up the correct method of maintenance after construction, but will deal entirely with the two types of construction most commonly used by engineers today, viz: The bituminous road constructed by penetration method, and the bituminous road constructed by mixing method.

Speaking generally of the two methods of construction, and taking into account the hundreds of miles of bituminous roads already constructed, I feel safe in saying that there is probably no other type of construction about which there is less absolute information concerning the physical and chemical characteristics of the bituminous materials and the road metals which will bring about the best results. There is no type of road construction which requires more care or more consistent expert supervision and inspection than that involved in the use of bituminous material, and, until such time as we are able to thoroughly educate and instruct efficient and capable engineers and inspectors in this type of construction, the same will remain in an experimental stage. In general, also, I would state that the preparation of the sub-grade, the drainage, and the foundation are extremely important factors in the success of bituminous pavements, and, unless properly constructed, will bring about their destruction. I might state at this time that, to my mind, the experimental stage in foundation work has been passed, and, that for the ordinary country traffic to which the average highways must be subjected, an eight-inch Telford foundation, or a five-inch cement concrete foundation, when properly constructed, is sufficient for the carrying of any class of pavement which we may desire to place thereon.

Penetration Method

Presuming that the foundation has been properly completed, I do not believe that I can better describe the method of building thereon a bituminous penetration pavement than by quoting from the Pennsylvania State Highway Department's specifications, to wit:

> "Upon a suitable foundation there shall be spread a layer of broken stone of such quality as may be suitable. The stone shall be broken in fairly uniform and regular cubes, free from dirt or dust, and comparatively free from flakes or splinters. The stone shall be of such size that they will pass a one and one-half inch circular opening and over a three-quarter inch circular opening. This layer of stone shall be of such thickness that, when it has been rolled with at least a ten-ton power macadam roller, it shall have a thickness of three inches.
>
> The surface must be firm and, when completed, correspond to the grade in proper crown of cross-section. Upon each square yard of this surface shall be evenly spread, by means of an approved pressure distributor or fan-spout sprinkling-pot, from one and one-half to one and three-quarter gallons of bituminous material, of a penetration from 90 to 120 lbs.
>
> The bituminous material shall be heated to a temperature of approximately 350 degrees F. Immediately thereafter, sufficient dry, dustless screenings, passing a one-half inch screen, shall be spread in sufficient quantities to evenly cover the surface of the road and take up excess bituminous material. The road shall then be rolled until firm and a smooth surface results and conforms to the longitudinal and transverse section.
>
> While the surface is clean and warm, a seal coat of bituminous material of proper consistency to be flexible when cold, shall be spread one-half gallon to the square yard. It shall be applied while at a temperature of 350 degrees F., and, while the bituminous material is in a liquid state, there must be spread a top dressing of clean, dry, Torpedo sand, or dustless stone chips, in sufficient quantities to cover the entire surface of the road and take up any excess bituminous material.
>
> Immediately thereafter, the road shall again be thoroughly rolled; if so directed, the stone, chips, and sand must be heated. In rolling, the roller should start from the side line and work toward the center, and, in all cases, continued until thorough compression is secured."

By following these instructions, a first-class penetration pavement can be constructed, but, in the experience of the Department, the Engineer has continually occurring the several conditions which I am about to enumerate, any one of which, escaping his attention, will be bound to produce a weak spot in the pavement, to wit: The presence of water in the foundation, due either to wet weather springs, or to rainfall after the foundation has been placed. This condition results in water working up through the telford stone; thence through the stone comprising the aggregate of the pavement; and attacks the bituminous material which, losing its bonding powers, readily disintegrates the pavement. Another condition, ofttimes occurring, is due to the contractor not napping his telford properly and attempting to bring the same to the proper crown and cross-section by the use of stone spalls. These cannot be thoroughly rolled into the foundation, and, when the stone which is to be treated with bituminous material is hauled on the road, the spalls continually work up through the smaller stone and produce a weak place in the finished pavement.

Soft Stone a Problem

The use of soft stone, especially in districts where local stone is used for road purposes, furnishes another problem for the engineer. Soft stone, when placed in the pavement and rolled, may seemingly be treated with bituminous material and thus cover up all cracks or fractures which may have been made by the initial rolling, but the rolling of the pavement, both after the first application of the bituminous material and by the final compacting of the same, will again fracture more or less of the stone aggregate. These fractures, occurring as they do after the application of the bituminous material, will be void of binding qualities and the stone will immediately start to break down through continued rubbing, one piece against the other. This, in itself, produces dust and allows the moisture to penetrate into the pavement, again causing destruction to the bonding powers of the bituminous material. In addition, this soft stone is readily worn away by passing vehicles and serves to shorten the life of a bituminous pavement.

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*Presented at the Third American Road Congress, Detroit, Sept. 29-Oct. 4.

†Chief Engineer, State Highway Department of Pennsylvania, Harrisburg, Pa.

Stone crushed in quarries, where there is an abundance of stripping, or where there is a strata of soft stone, or stone hauled upon the highway and allowed to stand for several days subject to clouds of dust from passing vehicles, become covered with a fine film of dust particles. Stone of this character, when placed in the road and subjected to the application of bituminous material, cannot be properly bonded, inasmuch as the bituminous material, while covering each stone, is unable to directly bond itself to the stone proper, for the dust layer covering the stone will act as a barrier and, while the bituminous material will or may hold the stone in place in the pavement, it will not have the proper bonding of one particle of stone with another. Stone with a smooth non-porous surface will prove a failure on account of the inability of the bituminous material to adhere thereto. Wet or damp stones result, likewise, in the bituminous material not obtaining any adhesion. It is well also to avoid those classes of stone which do not crush in a cube or near-cubical shape. Stone that break or crush in splinters will not take the compression and will not interlock themselves one with the other in the manner most desired in accomplishing first-class results.

Selection of Binder

The selection of a suitable binder is a most important matter, requiring skill and judgment. There is no one "best" product, and the selection must be governed by a number of conditions. The principal feature to be considered in this connection are: The characteristics of the stone to be used; the manner of applying the bituminous cement—whether the material is to be applied hot or cold, by means of distributors with or without pressure, or by pouring-pots—the quantity and character of traffic to which the road will be subjected; climatic conditions; the cost of bituminous material; and the probable cost of application.

Inasmuch as the results to be obtained are the securing of a compact, uniformly solid paving surface, impervious to water, it is obvious that continued and experienced supervision and exceptional care be taken. Equally important with the selection of the bituminous material is the care with which it must be heated, as the slightest over-heating will burn the product and render it unfit as a binder. It has been my experience that no successful results can be accomplished unless the inspector keeps continually with him on the work a thermometer, with which to test the temperature to which the bituminous cement is being subjected. Another frequent failure occurs through lack of uniformity in the quantity of bituminous material applied to the stone and is caused by crude or careless applications, and cannot bring about proper results. The hand-pouring should be supplanted by suitable mechanical distributors which will apply the bituminous cements under pressure and insure thorough penetration and a more even application.

In enumerating the various mistakes which so often occur in penetration work, I would say that the cause of failures can be readily traced in many instances to faulty plans and specifications, lack of care and judgment in the selection of materials, poor and inadequate equipment with which to carry on the work, inexperienced labor for both skilled and unskilled service, continuation of work during unseasonable or inclement weather, and insufficient funds to expedite the work under way. I might say in passing that probably the most noticeable cause of failure is that a class of incompetent contractors, having absolutely no experience in bituminous construction, bid on highway work and look to the engineering department as a school of instruction for their guidance.

As to what the life of a bituminous penetration pavement will be, time alone can tell, as the body of these roads contains a mass of material that is not evenly, properly, or finely graded. There exist sections that are both coarse and fine, permitting an application of the bituminous binder either in excess or deficiency; and, possibly, in some instances, only a light seal application is secured. While this condition does not exist generally, I must acknowledge that it is there and feel that wherever this method of construction has been, or is being, followed, it is only a question of time until the weak places show signs of disintegration; these, of course, can be repaired by an efficient maintenance force, and upon this maintenance force the probable length of life of this type of pavement depends. Where this class of pavement is supervised under the most expert management, the results at best are only those of a surface character and produce a road that for the time being seems to give satisfactory results.

Bituminous concrete pavements, constructed by the mixing together of stone, sand, and bituminous cement, in mechanical mixers, reduce the chance of failure to the minimum and eliminate many of the causes of failure found in penetration construction.

It is not necessary for me to discuss here the material, its size, quality, or character, or to explain in detail how this mixture is secured, as the average engineer is well acquainted with this type of pavement, inasmuch as it is very similar to the mixtures used in all the large cities for street purposes. While the best results from this type of pavement are obtained by using a cement concrete foundation, it is not absolutely necessary that such a foundation be used, as experience has demonstrated that water-bound macadam roads, where they have been properly drained, can be resurfaced with a mechanical mixture, and the results therefrom compare favorably with those of sheet asphalt streets. This type of construction has been a success and I feel safe in saying that most of the old water-bound macadam roads that have been torn by the heavy traffic can readily be brought to grade, properly crowned, made firm, and covered with a bituminous concrete that will be economical and serviceable for many years.

I do not very much believe in the use of telford foundation for a mechanically-mixed surface, as it is almost impossible to obtain, upon a telford foundation, a surface that will not be more or less wavy, and we all know that bituminously-constructed pavements, which have a wavy surface, are soon doomed to destruction. In the construction of this type of pavement, there are a few points which must be closely watched: The first—and to my mind the greatest—is the resultant mixture produced by the majority of mixers at present in use. There is a tendency in all revolving mixers to bring the large stone together, and, unless in the dumping of the mixer this is closely watched, the purpose of mixing will be defeated, which is that of having the aggregate of different sizes so mixed as to give the lowest percentage of voids. This condition will again arise if the material has to be transported a very great distance from the mixer to the road, as there will be a tendency for the larger stone to work toward the top of the load and the smaller material toward the bottom. So, it is important, in placing the material in the pavement, that it should first be dumped upon a platform, and from there shoveled into place in as uniform a mixture as possible.

I have used two distinct types of mixed bituminous construction. One, a cut-back bituminous material which remained in a plastic state for several days after being placed on the road, thereby bringing about a continuous bonding process, by means of local traffic passing over the road. The result of this was to bring about a perfectly smooth and uniform surface, in which there was probably from 70 to 80 per cent. of mineral aggregate exposed, which furnished traction for horses' shoes and automobile tires, thus eliminating one of the great criticisms of this type of pavement. The other, a straight bituminous material of approximately 60 to 70 penetration, upon which a seal coat was used to bring about a smooth and compact surface.

Care should be exercised in determining the sizes of stone for the type of pavement which is to be constructed. From experience, I do not believe it wise to use any stone larger than will pass through a one-inch ring, in the construction of a pavement upon cement concrete foundation, inasmuch as, in this type of pavement, while the load is seemingly carried upon the surface, it is in reality carried directly upon the foundation, and, if stone larger than one inch in size is used, there will be a likelihood of the larger stone occurring directly upon one another, thus throwing open the chance of fracture to either or both stones by impact from horses' shoes, or weight from the tires of heavily-loaded wagons.

Another point that does not favor the larger stone lies in the fact that sooner or later the stone is exposed in the surface in its largest diameter, again placing it in a position to be fractured by traffic. When such fracture occurs, unless the pavement is treated from time to time with light applications of bituminous cement, it opens the way for moisture to enter the pavement and thus destroys the binding quality of the bituminous material.

Where ordinary care has been taken in the construction of mixed bituminous pavements which have come under my observation, the results obtained fully warrant a continuation of this kind of construction, and I believe that the time is not far distant when the experimental stages of these pavements will be a feature of the past, providing explicit specifications are drawn to plainly designate the quality of all bituminous and other material desired in each individual job, and the old practice of copying specifications and methods in use elsewhere, regardless of local conditions such as drainage, sub-base, and traffic, is discontinued; and providing we are successful in properly educating highway engineers, inspectors, contractors, and the forces, both skilled and otherwise, in connection with the use of all materials that enter into the construction of this class of paving; and I consider that in the very near future there will be little distinction between the general specifications that designate the construction of highway pavements and those that designate the construction of city streets, inasmuch as the automobile and automobile truck—which are the most dangerous factors in the destruction of the average pavement—will traverse the city street and the country road in equal numbers.

The Third American Road Congress

Detroit the Mecca of Good Road Enthusiasts—Representative Gathering in which Canadians Played Prominent Part

THE Third American Road Congress, which was held at Detroit, Mich., September 29-October 4th, was attended by some five thousand delegates from all parts of the continent. Canada was well represented and Mr. A. W. Campbell, Deputy Minister of Railways and Canals, was among the speakers at the opening session.

Mr. Campbell outlined the Canadian prospective federal legislation to aid in the construction of principal roads, as submitted at the last session of parliament, and vouchsafed the view that interest in the highways movement had not terminated with the differences of political opinion which occurred over the terms of the measure of last spring.

Mr. Campbell impressed upon the congress the importance of planning in a comprehensive way for the requirements of the state, the class of roads necessary, the materials to use and how to use them. He emphasized the maintenance problem and urged that construction should not be undertaken without providing adequate and systematized methods of maintenance.

Mr. W. A. McLean, Provincial Engineer of Highways, who was accompanied by the Hon. Dr. Reaume, Minister of Public Works for Ontario, was particularly active, gathering material upon which to base recommendations for the Ontario Legislature.

The Hon. Dr. Reaume had the honor, on the opening day, of proposing the toast to the President of the United States. "Canada stands for unrestricted reciprocity in road-building," declared Hon. Dr. Reaume, amid applause. He declared that the Government of Ontario purposed to inaugurate a new era of highway construction along modern and approved lines, and to this purpose the Commission, headed by Mr. Magrath, was at work. "We have tried various systems in various localities," proceeded the Minister. "We have sought to open up New Ontario under a system of colonization roads, but we have realized that we cannot thus cope with the situation. In old Ontario we have had the highways improvement act, which worked well for years, but with the advent of heavy modern automobile traffic it has not proved satisfactory. We have a large province, not so densely populated as most of your States. We have a larger problem in that regard than you, and we do not propose to spend money haphazard. At the latest sitting of the Legislature we appropriated $5,000,000 to the work, and there are more millions behind.

Dr. Reaume stated that Ontario would act following the report of the Commission. It desired to be guided by the wisdom of experience, and thus had come to "this school of international philanthropy."

That Quebec proposed to vie with Ontario in the business like enterprise of good road making, was the message of Hon. Mr. Caron, who followed. Quebec desired the Congress to meet in that province because she was deeply interested in what the Congress was doing. "We are ready to take lessons from Ontario, from the United States, or from any country which can teach us," Mr. Caron declared.

Quebec had been working diligently on the road problem for the past three years. The Provincial Government had appropriated $10,000,000 to the enterprise, and already $8,000,000 of this had been applied for by the counties to which it was advanced. In three years hence he expected the big modern trunk highways from Quebec city to Montreal and from Montreal to the border to be completed.

Colonel Sohier, Highways Commissioner for Massachusetts, speaking for the various State Commissions, paid high tribute to Canadian enterprise and endeavor. He gave assurance that the members of the Ontario Commission would find a warm welcome awaiting them wherever they went, and eulogized Mr. W. A. McLean for the work he had already done as Highways Engineer.

An outline of the programme was given in an earlier issue of the Contract Record. Many valuable papers were presented. In our issue of October 1 we published two of these—"Requirements of Waterway Structures," by Mr. A. R. Hirst, State Engineer of Wisconsin, and "The Selection of Macadam Road Material," by Mr. L. W. Page, Director of the U. S. Office of Public Roads, Washington, D.C. Elsewhere in this issue will be found interesting papers entitled, "Treatment of Worn Out and Ravelled Macadam Surfaces," by Col. E. A. Stevens, State Highway Commissioner of New Jersey, and "Bituminous Construction," by Mr. S. D. Foster, Chief Engineer, State Highway Department, Harrisburg, Pa.

An exhibition of road machinery and appliances was held concurrently with the convention. The Office of Public Roads of the United States Department of Agriculture exhibited two series of miniature models, one showing the development of road building from the early Roman roads to the types of road now in use, the other showing all modern types of road, such as sand-clay gravel, water-bound macadam, bituminous macadam, brick concrete, etc. The exhibit also included models of bridges, culverts and drainage structures, electrically-operated models of rollers, etc.

Growing Optimism in the Coast Province

Vancouver Reports Improved Financial Conditions with Several Costly Undertakings Maturing—Fireproof Structures Gaining in Favor Rapidly

Office of the Contract Record,
Vancouver, October 2, 1913.

An examination of the building and contracting situation in the southwestern portion of Canada's Pacific Coast province reveals the presence of a strong undercurrent of confidence in the stability of our principal cities which augers well for future development along the lines of construction in British Columbia. In the city of Vancouver alone, there exists at the present time a more optimistic feeling with regard to future conditions in the local constructional field than has been observed for some months past. There can be no question but that the chief element influencing an improvement in the general outlook is the gradual relaxing in the financial situation in Western Canada. A number of large undertakings which have been tied up for the greater part of this year on account of the difficulty in securing adequate loans are now in a fair way to be successfully launched, and although no definite announcements have as yet been made, it is understood that active operations will in all probability be inaugurated in the case of several extensive projects before the end of the present year.

These include office buildings and hotels in various parts of the city, a theatre with seating accommodation for 1,400 people on the corner of Granville and Nelson streets, a large vaudeville and moving picture theatre near the corner of Carral and Hastings street, another moving picture theatre on Granville street, the new east wing of the Provincial court house costing about $350,000, and quite an imposing list of other buildings ranging in cost between $20,000 and $100,000, on which work is scheduled to commence just as soon as financial arrangements will permit. Credence is being given a persistent report in Vancouver to the effect that the Bank of Commerce has purchased a site at the corner of Pender and Main streets measuring 57 x 120 feet for approximately $3,000 a front foot, and is considering the erection of an extensive branch office building on this location.

One of the most noticeable features in connection with local buildings of recent months is the tendency to erect fireproof structures of a permanent description entailing the use of reinforced concrete, in place of mill construction. Quite a large proportion of the permits taken out this year have been for reinforced concrete buildings and it is estimated that permits for this class of building will show an even greater increase during the ensuing twelvemonths.

On September 25 the number of permits of all classes which had been issued at Vancouver since the first of the month totalled 136, valued at $1,244,888.

In the opinion of the Vancouver building inspector, the value of permits for the whole of this year will fall short of the figures for 1912 by $3,000,000 approximately. This is a comparatively small decrease in view of the discouraging financial conditions which have been in evidence since the beginning of the present twelvemonth period.

Important Additions to Big Hotel

The most important permit issued at Vancouver during September was one for $1,100,000 to provide for the erection of the east wing of the New Hotel Vancouver, and an addition of four storeys to the central portion of the building now under construction. Messrs. Skene & Christie, a well-known local contracting firm, having charge of the entire contract. The first permit taken out for the central portion allowed for only eleven storeys. This will now be increased to fifteen storeys. The section of the new east wing adjoining the central part of the hotel will be eleven storeys high, and the portion fronting on Granville street will be seven storeys. Along with the permit previously taken out, the total cost authorized to date is approximately $2,000,000. The alterations and additions to the west wing will be contained in a later permit. The centre part is to be surmounted by a roof garden forming the sixteenth floor. The present west wing will be left practically as it stands, but several storeys will be added to it in order to conform with the general architectural scheme of the whole.

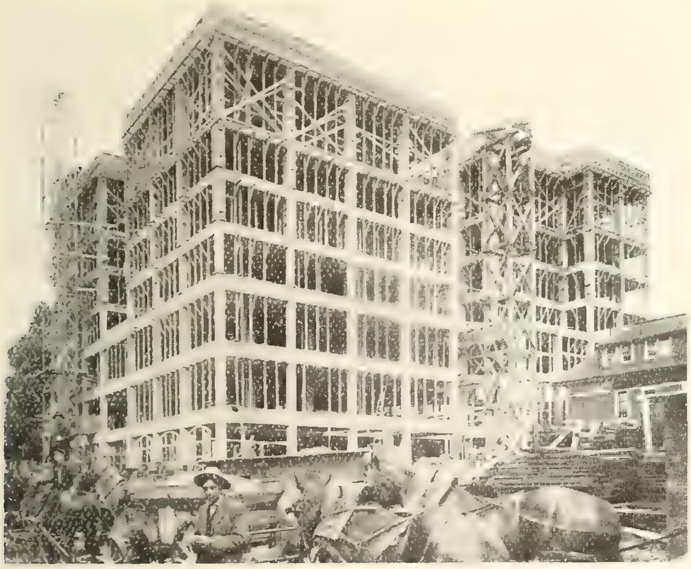
Splendid New Shaughnessy Heights Residence

Among the list of other buildings for which permits were issued during September was an artistically planned residence for Mr. A. E. Tulk, of Vancouver, costing about $75,000, upon which construction is already well under way at Shaughnessy Heights. This building is designed after the Elizabethan style of architecture. The exterior will be finished in tapestry brick and dressed Haddington Island stone. The roof will be covered with plain English tile, and all chimneys are to be built of brick and stone. The windows will be fitted in steel casements, and glazed with leaded glass. All the principal rooms on the ground floor of the interior, as well as the entrance hall and corridor, will be finished in hardwoods. Enriched plaster ceilings will be a feature in the principal reception rooms, and also in the boudoir, situated on the first floor. The bedrooms and other apartments on the upper floors are to be finished principally in white enamel. Hardwood will be extensively used for the floors throughout the building.

The remainder of the equipment includes among other items, complete plumbing and hot water heating systems. The excavation and concrete pier foundation of this residence were completed some weeks ago, and good progress is being made on the later stages of construction. Messrs. McLure & Fox, of Vancouver and Victoria, are the architects, and the general contract is in charge of Messrs. McPherson & Sinclair, Vancouver.

New Sub-Post Office Described

It is expected that tenders will be invited very shortly for the erection of the proposed sub-post office building in Mount Pleasant, Vancouver, plans for which are now in course of preparation by Mr. A. Campbell Hope. The building is to be fireproof throughout and constructed entirely of British Columbia materials. Below the ground floor the material used will be Denman Island stone; from the ground floor up to the eaves Haddington Island stone and pressed brick will be employed. The cornices and pilasters will consist of stone suitably carved. The interior of the building will be finished in marble slabs. The dados will be of marble and the columns, capitals and moulded cornices will be of carved stone. The floors are to be of concrete with hardwood finish, and terrazzo in places. The building will be heated with hot water and the usual radiator system with ventilation through the outer wall. The windows will be of plate glass made to slide behind the stone tracery. The stairs will be of steel frame with marble treads; the landings and enclosing walls are to be of concrete with marble finish. The cost of the construction will be in the neighborhood of $100,000.



Y. M. C. A. building under construction, Georgia Street, Vancouver.

Progress of the Y. M. C. A. Building

The photograph produced herewith shows the reinforced concrete frame work completed on the new Y. M. C. A. building at Vancouver. This structure has a frontage of 131 feet on two streets—Georgia and Alberni—and measures 132 feet in depth. It is of reinforced concrete and steel construction, the first two storeys being of steel. Terra cotta will be used in the first storey, while the succeeding five storeys will be faced with red paving brick, and the top storey will be of terra cotta with galvanized iron cornice. On the Alberni street frontage the exterior facing will be red paving brick with terra cotta trimmings. All interior woodwork will be of British Columbia fir. The entrance on Georgia street and the vestibule of both entrances will be decorated with terra cotta. The basement floor will contain a cafeteria, kitchen, barber shops, lockers, swimming pool, general lavatory, shower baths, boiler rooms and attendants' rooms. The swimming pool will be a feature of the building. It will measure 75 feet by 24 feet, with a depth of 7 feet 9 inches at the deepest end, grading to 4 feet 3 inches at the other end. The walls of the room in which the swimming pool is located will be lined with white enamel tile. The swimming pool and the floor of the room will be of white hexagonal tile, and there will be a white terra cotta life-rail. There are two spectators' galleries in this room. The floor of the locker rooms will be of cement, while the floor of the cafeteria will be of terrazzo. A filtration plant will be installed to purify the water before it enters the swimming pool. On the first floor will be located the reception lobby, social room, club room, reading room, writing room, the general offices, committee rooms, auditorium and banquet hall, boys' game room, together with coat rooms and dressing rooms. The reception hall is to be panelled in British Columbia fir, and the boys' lobby panelled in burlap. On the second floor there will be a main gymnasium and an auxiliary gymnasium, together with boxing and wrestling rooms, fencing room, physical director's room, club rooms, employment department and class rooms. The floors of the gymnasium will be of maple, and walls of main gymnasium lined with buff brick and walls of auxiliary gymnasium with cement plaster. All the other rooms on this floor will have a covering of battleship linoleum, with the walls plastered with ordinary plaster.

The third storey will comprise the running track, which will have a fir floor covered with felt. The gymnasium will extend in height for two storeys. Besides the spectators' gallery there will be located on this floor a private dining room, ministers' parlor, ladies' parlor, library, museum, educational secretary's room, five class rooms and rooms for headquarters and supervisory and extension agencies.

The fourth, fifth, sixth and seventh storeys will be set aside for bedrooms. On each floor there will be about forty-three bedrooms and one large dormitory. Accommodation will be provided for about seventy-seven persons on each floor, making in all living accommodation for nearly 320. One big lavatory will be provided for on each floor, and each room will be equipped with a telephone. The floors of the dormitories are to be of cement.

Located on the roof will be the laundry. It is placed on the roof in order to save space in the basement. One passenger elevator will be in use. Steam heat will be used throughout, and the building will be equipped with an oil-burning apparatus. The building will be ventilated by a system of fan ventilators, which will change the air about four times every hour.

The total cost of construction has been estimated at approximately $350,000, while an appropriation of $50,000 will be made to cover the interior equipment and furnishings, Mr. H. S. Griffith, of Vancouver and Victoria, is the architect, and Messrs. Booker, Campbell & Whipple, of Vancouver, have charge of the construction .

VICTORIA CONTRACTS PLANNED

Features of the Hudson's Bay Company's New Store

During the third week in September the excavation work on the site of the Hudson's Bay Company's new departmental store in Victoria was inaugurated, and it is expected that the contract for erecting the superstructure will be awarded in a few weeks' time. The building has been closely modelled after the style of the Calgary store, but according to the plans it will be more attractive as regards its exterior appearance than the latter establishment. It will have a frontage of 240 feet on Douglas street and 120 feet on both Fishguard and Herald streets. There will be two fine entrances on the former thoroughfare, and one each on the two other streets. The exterior facings are to be entirely of terra cotta. The base of the pillars on the three street elevations will be square and of exceptionally large dimensions. From the first storey up these will be converted into fluted Corinthian columns, and will provide one of the most attractive features of the architecture. Only four storeys will be proceeded with at present, but it is the intention to add four or six additional floors at a comparatively early date, the plans providing for extra strength in the construction of the basement and lower storeys in order to support the extra floors when these will be required.

The first section of the project alone calls for an expenditure of approximately $450,000, and the cost of the completed building has been estimated at $600,000. Forty departments are being arranged for in the present establishment, and upwards of 400 employees will be required. The equipment throughout will be thoroughly in keeping with the requirements of a modern departmental store, and only high grade materials will be used in the construction. Messrs. Burke, Harwood & White, of Toronto, are the architects.

Personal Mention

Mr. Chas. Curtis, manager of Western Pavers, Limited, Winnipeg, is well known in many parts of Canada. Like many another good man he obtained his early experience in Toronto, receiving his training from such men as Sir William Meredith, Hon. W. T. White, the present Minister of Finance, and others. Mr. Curtis has filled many positions in paving companies. Within recent history he was appointed first commissioner of the city of Saskatoon, Sask., at a salary of $6,000 a year, but resigned the appointment shortly afterwards when he found that his hands were tied, after the manner common to city officials. Mr. Curtis went back to his former business and is doing excellent work as Manager and Secretary of Western Pavers, Limited. Since 1910 his firm has completed contracts for sidewalks and curbs representing almost a million dollars in value. These contracts were in Saskatoon, Regina and Edmonton and have no regard to large quantities of work in the smaller towns and cities of the West.

Mr. Chas. Curtis, Winnipeg.

Mr. E. L. Cousins, Chief Engineer, and Mr. A. C. Lewis, Secretary, of the Toronto Harbour Commission, were in Ottawa last week for the purpose of discussing with the Minister of Public Works the transfer of certain property required by the Commission in the fulfilment of its development schemes.

Mr. J. N. Finlayson has been appointed Professor of Civil Engineering at Dalhousie University, Canada, vice Professor C. D. Howe. Mr. Finlayson was educated at McGill University, and later served for two years as instructor in the department of civil engineering at McGill. He has been with Waddell & Harrington, consulting engineers, during the past two years.

Mr. J. C. V. Horwood, of Messrs. Burke, Horwood & White, has been at Victoria, B.C., in connection with the Hudson Bay Company's new store, for which his firm are the architects.

Sir Maurice Fitzmaurice, the eminent London engineer, who has supervised several big Canadian undertakings and who is a former contributor to this journal, has been invited to proceed to Australia to advise the Commonwealth government on the establishment of a chain of naval bases.

Mr. E. E. Sands, Supervising Engineer, department of Natural Resources, Canadian Pacific Railway, with headquarters at Calgary, Alta., was recently appointed City Engineer of Houston, Tex., succeeding Mr. Frank L. Dormant. Mr. Sands is a graduate of the University of Wisconsin, class of 1900, where he served for the two succeeding years as instructor in civil engineering, when he entered the United States Reclamation Service.

Mr. F. J. Herlihy, of Great Falls, Montana, has been appointed chief engineer of the enlargement of the Montreal aqueduct, the contract for which was recently awarded to the Cook Construction Company, of Sudbury, Ont. Mr. Herlihy has been connected with some of the largest engineering enterprises in the United States, and was until recently engineer in charge of bridge and building construction on the Milwaukee Railway's Great Falls-Lewistown line. He designed and built the west Milwaukee terminals for the Milwaukee road, and also had charge of the bridge and building work for the Milwaukee's Puget Sound division west of Butte. The object of the enlarged aqueduct is to generate 100,000 horse-power, which will be used to pump water into the reservoirs and also to enable a scheme of municipal lighting to be carried out.

Mainly Constructional

The News in Brief—From Coast to Coast

E. J. Ryan, Limited, is the name of a new concern which has incorporated at Vancouver as builders and contractors with a capital of $100,000.

The Dominion Bridge Company have purchased a block of vacant land adjoining their property in Longue Pointe, P.Q., for an extension of their plant.

The North Vancouver district council recently decided to have a building and plumbing by-law prepared so that uniform regulations in that regard would be ready for next year.

Excavation has commenced at the site of the Hudson Bay Company's departmental store at Victoria, B.C. When completed the building will represent an expenditure of $600,000.

The Industrial Foundation & Waterproofing Company, 25 Toronto Street, Toronto, are supervising the installation of the foundation and waterproofing of the new Dominion Bank, Yonge and King streets, Toronto.

It is stated that the largest programme of surface local improvements ever undertaken by the city of Edmonton is now nearing completion. The 1913 programme has involved sixty miles of paving at an expenditure of $1,700,000.

Hamilton By-Product Coke Ovens, Limited, are contemplating the erection of a large plant in Hamilton, Ont. The initial expenditure is placed at $1,500,000. The first unit will be built on a 33-acre site on the bay shore, in the east end, and will consist of 50 ovens, each of 16 tons capacity, operating on 18 hours coking time. A 5,000,000 cubic feet gas holder will also be erected there. The plant will carbonize 1,000 tons of coal per day, producing 700 tons of coke per day. Over 100 men will be given employment at the start. United States capital holds a controlling interest.

The B. C. Granitoid & Construction Company, Vancouver, has been awarded a general contract covering the construction of a four-storey reinforced concrete hotel building in Victoria, for Mr. C. M. Cookson. Mr. L. W. Hargreaves was the architect.

A contract for the crushed rock supply required in the concrete work for the Hudsons Bay Company's new store at Vancouver has been awarded to the Whinstone Macadam Quarries Company, 310 Richards street. The order will embrace about 10,000 cubic yards of material.

Messrs. Perry & Fowler, architects, Vancouver, who have been commissioned by the Dominion Government to prepare plans for the proposed drill hall in the Grandview district, announce that it will be at least the middle of November before the plans are ready for contractors to figure on.

For the month of September Montreal's building permits totalled $1,199,304, a decrease of $146,495, as compared with the same month last year. From 1st January to 30th September the value was $15,816,018, a gain of $2,488,952 over the corresponding period in 1912.

The Department of Public Works of the Dominion Government has awarded a contract to John S. Metcalf Company, Limited, Constructing Engineers, Montreal, for about half a mile of grain shipping conveyor galleries at berths No. 5 and No. 6, Sand Point, West St. John, N.B. The approxi-

Work is due to commence on a modern three-story apartment building with full basement to be erected in Victoria by the Equitable Bond Corporation, Limited. The plans show a building measuring 50 x 120 feet, with brick veneer exterior. The apartments will consist of two and three rooms each.

Mr. Newton J. Ker, the former city engineer of Ottawa, who now occupies a position with the C. P. R. in British Columbia, has submitted an application to the city of Ottawa requesting that he be given a $2,000 retiring allowance—following the precedent of the council in voting this amount to the former city solicitor.

Constructional operations have been started on the new grand stand at the Woodbine race track, Toronto. The total frontage of the stand will be 400 feet and there will be a depth of 52 feet. The seating capacity will be 8,050. There will be three exits. Mr. Geo. W. Gouinlock, of Toronto, is the architect.

In the recent competition for plans for the proposed Hollywood School in Victoria, the designs submitted by Messrs. Spurgin & Wilkins, a local architectural firm, were awarded first place. Second place in the competition was given to Mr. Arthur Fleet, also a local architect. It is intended to undertake construction of this new school without delay.

E. F. Giberson and Company, Limited, Montreal and New York, have obtained the contract for supplying "Real Bedford" Indiana limestone for the Express Terminals of the C. P. R., Toronto, for which Messrs. Hutchison, Wood & Miller, Montreal, are the architects, and the Peter Lyall & Sons Construction Company, Limited, the general contractors.

Messrs. Cauchon & Van Tyne, architects, have completed plans for a seven-storey steel building, 25 x 150 feet, on Rice street, Edmonton, for Mr. Edwin Auld. The cost is placed at $110,000. The lower floor will be a store, with 70 offices on the six upper storeys. Tenders have been called for the construction work. The building is to be completed early in 1914.

It is understood that tenders for a large apartment block to be built on the Fairfield Estate in Victoria will be called for at the beginning of October. Mr. Bryant Newbold is the architect for this structure, which is estimated to cost approximately $70,000. No details of the construction other than that the building will be modern and fully equipped, are available at the present time.

Messrs. Sloane & Harrison, of New Westminster, were recently awarded the contract for building an addition to the Dominion Government building in that city, which will provide increased accommodation for the postal and other departments. The tender was for $48,000, but the structure will cost altogether about $60,000. The building will be three storeys high, with a basement—on a ground space of 32 by 54 feet.

Plans for the Prince Rupert drill hall, for which tenders closed at Ottawa on September 23, call for a building of cement, stone and brick construction. It will have a length of 201 feet and a width of 84 feet. The drill hall proper will measure 125 x 77 feet. A nine foot basement is provided for and will be used as a shooting gallery. The outside measurement of the height of the building is 104 feet. No estimate of the cost of construction is available at present.

At the annual general meeting of the British Columbia Society of Architects, Vancouver chapter, held on September 4, the following were elected as the new executive and council for the chapter, year 1913-14: Mr. C. J. Thompson, president; Mr. W. M. Dodd, vice-president; Mr. J. Drummond Beatson, honorary secretary; Mr. Robert Lyon, honorary treasurer. Council: Messrs. G. A. Birkenhead, Franklin Cross, C. B. Fowler, W. F. Gardiner, G. A. Horel, W. T. S. Hoyt, T. E. Julian, J. G. Liebert, J. L. Putnam and F. G. Gardiner.

The Toronto Board of Control has awarded the first contracts in connection with the Humber boulevard. The Asphaltic Concrete Company will construct a rocmac macadam pavement on the east bank of the Humber from the G. T. R. north to connect with Dolorway Point. The cost will be $1.62 per square yard. The same company will construct a rocmac macadam pavement on the east side from Bloor street, Weatherel street north and west to Gamble avenue for $1.67 a yard or 3,755 square yards for $6,262.50.

"Consol" Canadian-made transits and levellers, manufactured by the Consolidated Optical Company, Limited, 400 Richmond street west, Toronto, are the subject of an illustrated pamphlet which contains testimonials from a number of city engineers, railroad engineers and others. The company has every facility at its extensive plant and they claim that in buying a Canadian-made instrument not only is the duty saved but an instrument obtained that is adapted to local use and which can be repaired readily by the men who originally built it. Catalogue and quotations will be sent on request.

An Edmonton despatch says that the Government's long looked for solution to the Alberta and Great Waterways difficulty has been found in an offer from J. D. McArthur, Winnipeg, who has now under construction the Edmonton, Dunvegan and B. C. Railway. Mr. McArthur proposes to take over the A. and G. W. Railway and construct the line between Edmonton and Fort McMurray on a route approved by the Government, the specifications, however, to be similar to those of the E. D. and B. C. Railway. If the mileage between terminals does not exhaust the guarantee the remainder will be used for branch lines on similar terms, to be later specified by the legislature.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Harrow, Ont.
The Village Council plan new waterworks system for fire protection purposes. Further information from Clerk.

Montreal, Que.
Sewer, cost $4,000, Wiseman Ave., for Town of Outremont. Sec.-Treas., Mr. Sampson, Town Hall. Engineer, Mr. Duchastel, Town Hall, Outremont. Tenders received by Sec.-Treas. till Oct. 8.

Concrete sidewalks planned by Board of Commissioners. Sec., L. N. Senecal. City has decided to do this work themselves and has contract with cement people to purchase all material.

Ottawa, Ont.
Pavement, cost $5,000, Lakeside Ave., planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Macadam pavement with tarvia finish. Tenders will be called this week.

Stamford Twp., Ont.
Waterworks, cost $10,000, planned by Twp. Council. Clerk, C. F. Monroe, Southend. Engineer in charge, J. C. Gardner, Niagara Falls. Specifications at office of Engineer. Artesian wells, electric pumping plant, pipe line.

Toronto, Ont.
Tenders received until October 9th for construction of Midway sewer system, outlet via Hiawatha Ave., Gerrard St. and Morley ave. Plans at office of Works Dept. Board of Control. Mayor, H. C. Hocken.

CONTRACTS AWARDED

Barton Twp., Ont.
Macadamizing roads, Kilbogie Survey, planned by Twp. Council. Clerk, A. G. F. Bryant, Hamilton. Reeve, Mr. Gallagher, 16 James St. S., Hamilton. Engineer-in-charge, E. G. Barrow, John St. S., Hamilton. General contractor, R. J. Crossmore, Chedoke, Ont.

Beamsville, Ont.
Cement walks planned. Clerk, S. B. Bisbee. General contractors, Jeffries & Boughner. 12c. per ft.

Estevan, Sask.
Waterworks and sewers planned by Town Council. Sec.-Treas., P. J. Stephens. General contractor, Town Engineer. Engineers, Chipman & Power. Work being done by day labor.

Moncton, N.B.
Watermain, cost $767.70, John and Birch streets, planned by City Council. Engineer, J. Edington. Chairman, S. O. Humphrey. General contractors, Dan & Pat Gotro. Work to start at once.

Twp. Sandwich East, Ont.
Concrete pavement planned. Engineer, Owen McKay, Walkerville. General contractors, Guoin & Desjardins, Tecumseh, Ont.

Toronto, Ont.
Sewer, East Toronto Section A outlet, $86,000. General contractors, Jennings & Ross, 79 Spadina Ave. Transferred from Commissioner of Works.

Pavements planned by Board of Control. Bitulithic on Rosemount Rd. and Biggar ave., to the Warren Bituminous Paving Co., 103 Bay St., $12,674; brick block on St. Clair, to Grant Constructing Co., 50 Front St. E., $11,839; concrete on lane north of Queen E., from Parliament, to Riverdale Concrete Paving Co., 256 Jones; concrete on lane west of Yonge south from Elm, to A. J. Penberthy, 292 Booth ave.; General contractors, The Asphaltic Concrete Company, 74 King St. E.: brick block on Sorauren, $2,695; brick block on Sterling Rd., $16,990; concrete curbs, Sorauren ave. to Ramsay Contracting Co., 39 Indian Rd. Cres. Sterling Rd. to A. R. Buckles.

Sidewalks planned by Board of Control. General contractors, Grant Contracting Co., 50 Front St. E. Chalmers, Rockwell & Howick ave., $1.08 per lin. foot. Concrete curbs, Erindale Ave., to the Constructing & Paving Co., Confederation Life Bldg., 41c per foot. Concrete curb on Smith St., to Routly & Summers, 47 Benlamond at 45c per ft.

Sewage pumps, cost $4,227, required by Board of Control. General contractors, Drysdale & Co. Three motor-driven centrifugal sewage pumps for main drainage works.

Foot bridge, cost $12,000 over Don River, planned by Board of Control. Mayor, H. C. Hocken. Commissioner Harris has forwarded plans to Works Committee.

Sewer, cost $29,340, planned by Board of Control. General contractors, Gawne Contracting Co. Sec. No. 3 Wilton Ave., storm overflow sewer.

Valleyfield, Que.
Concrete wall, Beauharnois Canal, planned by Dom. Govt. Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General contractors, Cossette & Co., Valleyfield.

Walkerville, Ont.
Pavements, cost $8,000, planned by Town Council. Clerk, Cecil H. Robinson. Engineer, Owen McKay. General contractors, Cadwell Sand & Gravel Co., 84 Sandwich St., West Windsor. 5,000 sq. yds. concrete pavements on several streets.

Pavements and sewers planned by Town Council. Clerk, Cecil H. Robin- Public Works, until Oct. 29th. Plans, specifications, etc., at offices of J. G. son. Engineer, Owen McKay, C.E. General contractors, T. Chick & Co., Bruce and Elliott Sts., Windsor.

Welland, Ont.
Sewers, cost $10,000, Ross St. Chairman Sewerage Com., James Hughes. Clerk, C. M. Webber. Engineer-in-charge, D. T. Black. General contractor, I. Y. Harper, St. Thomas.

Winnipeg, Man.
Water main and granolithic walks, planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Ashley, engineer of construction.

Railroads, Bridges and Wharves

Province of Alberta
C. P. Rly. have approved locations of stations situated at Strathmead, N. E. ¼ Sec. 14-22-27, W.4.M. and at Strangmuir, S. W. ¼ Sec. 23 to 25, W.4.M.

Balgonie, Sask.
C. P. Rly. will construct 2 tracks of a Wye adjoining S. boundary of company's main line in Sec. 3-18-17, W.2.M.

Berlin, Ont.
G. T. Rly. has been authorized to construct siding across Wellington street.

Chocolate Cove, N.B.
Dredging and wharf extension. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 29th. Plans, etc., at office of F. G. Goodspeed, Dist. Engineer, St. John, N.B., Postmaster, Chocolate Cove, and at Dept., Ottawa.

Findlater, Sask.
C. N. Rly. has been authorized to construct branch line to gravel deposit near Findlater.

Hamilton, Ont.
G. T. Rly. has been authorized to construct sidings for Otis-Fensom Elevator Company.

Railway construction. Mayor, John Allan. City Solicitor, F. R. Waddell. Engineer, A. F. Macallum. On Oct. 10 at a meeting of the Dominion Railway Commission the city will present plans to have all lines enter via a north end route and the T. H. & B. tracks on Hunter St. from Aberdeen Ave. to Baillie St. abandoned. It is planned to have a common entrance for all railways and a Union Station at James and Stuart Sts. The G. T. Rly., C. P. Rly. and T. H. & B. are interested.

Havelock Sub-Div., Ont.
C. P. Rly. Co. has been authorized to construct bridge No. 75.6.

Kincardine, Ont.
Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of

Sing, Dist. Engineer, Confed. Life Bldg., Toronto, H. J. Lamb, Dist. Engineer, Windsor, Postmaster, Kincardine, and at Dept., Ottawa.

London, Ont.
London & Lake Erie Transportation Co. will build new line into London Brick Company's plant. Manager, S. Warburton.

Montreal, Que.
12 street cars and equipment required for Montreal & Southern Co. Rly., Canadian Express Bldg. Tenders received by Mr. Powell, c/o. Company.

C. P. Rly. Co. have approved clearances for new train shed at Windsor St.

Ottawa, Ont.
Bridge, cost $50,000, Bank St., planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Recommended to be built of steel instead of reinforced concrete, bridge will be 60 ft. wide.

Province of N.B.
Moncton & Northumberland St. Rly. will construct railway from Richibucto to Buctouche, a distance of 19 miles.

Province of Ontario
Michigan Central R. R. will construct bridge over Alexander Drain between Comber and Ruscomb.

Regent, Man.
C. P. Rly. will construct station on its Boissevain-Lauder Branch.

Regina, Sask.
C. P. Rly. authorized to construct spurs into premises of J. B. Tudhope & R. A. Carman, lots 31 to 40, block 200.

St. Jean Port Joli, Que.
Wharf improvements. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 28th. Plans, specifications, at office of J. A. Tremblay, Dist. Engineer, Montmagny, Chas. Chapais, Dist. Engineer, Post Office Bldg., Quebec, Que., Postmasters, St. Jean Port Joli, and at Dept., Ottawa.

Schepler, Ont.
C. P. Rly. Co. have approved location of station at mileage 51.4 on Fort Nicholl sub-division.

Stratford, Ont.
Water storage tanks. G. T. Ry. Co. contemplate the purchase of water storage tanks. Master mechanic, Mr. R. Patterson, Stratford.

Thornbury, Ont.
Harbor improvements. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 29th. Plans, specifications, etc., at offices of J. G. Sing, Dist. Engineer, Confed. Life. Building, Toronto, J. H. Armstrong, Dist. Engineer, Midland, Postmaster, Thornbury, and at Dept., Ottawa.

Toronto, Ont.
Board of Control has been authorized to construct viaduct carrying Bloor St. across property of C. P. Rly., C. N. O. and G. T. Rly. to connect with Danforth Ave.

Station and viaduct, cost $5,000,000, for C. P. Rly. and G. T. Rly., Montreal. Architects, Ross & MacDonald, 1 Belmont St., Montreal, and Traders Bank Bldg., Toronto. Plans will be ready to call tenders about January 1st, 1914. Steel, reinforced concrete and brick construction, concrete foundation.

Welland, Ont.
G. T. Rly. Co. has been authorized to construct siding into premises of S. L. Lambert.

Wellington, Ont.
Harbour improvements planned by Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Oct. 29th. Plans, etc., at offices of J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto Postmaster, Wellington, and at Dept., Ottawa.

Winnipeg, Man.
C. P. Rly. Co. authorized to construct spurs for Dominion Bridge Co., Ltd., on Saskatchewan ave. and extension to spur into premises of Western Coal Co., Ltd., Parish, St. John.

Yorkton, Sask.
G. T. P. Branch Line Co., has been authorized to construct spur for the International Harvester Co. of Canada, Ltd., turning out from its Yorkton branch in a northerly direction across Broadway in Sec. 35-23-4 and Sec. 2-26, W.2.M.

CONTRACTS AWARDED

Canso, N.S.
Wharf, cost $6,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Andrew McConnell.

Dorchester, N.B.
Reconstruction of wharf, cost $16,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Island Dredging & Construction Co.

Granby, Que.
Railway construction for Montreal & Southern Rly. Co., Can. Express Bldg., Montreal. General contractors, Ross & McCombe. Mr. Ross, c/o Queens Hotel, Montreal.

Levis, Que.
Double-tracking railway to Chadiere Junction, for Intercolonial Rly. Co. Manager, F. P. Gutelius, Moncton, N.B. General contractors, Messrs. Soper & McDougal, c/o Gen. Manager. Eight miles double track.

London, Ont.
Bridge, cost $28,000, Wharncliffe Rd., planned by City Council. Chairman No. 2 Com., B. W. Bennett. Engineer, W. N. Ashplant. Steel work, Hamilton Bridge Works Co., Barton and Bay Sts., Hamilton.

Twp. Sandwich East, Ont.
Concrete culvert planned by Twp. Council. Engineer, Owen McKay, Walkerville. General contractors, Guoin & Desjardins, Tecumseh, Ont.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.
Operating room, cost $3,000, contemplated by Hospital Board. Chairman Bldg. Com., Dr. Bell. Architects, Wicks & Green, Buffalo, N.Y. Tenders to be called shortly.

School contemplated. Finance Com. of City Council recommend by-law to raise $45,000 for new building in Eastwood.

Calgary, Alta.
Industry housing building, cost $250,000, 9th and 5th, planned by City Council. Clerk, J. M. Miller. Architect, Alex. Piria, Board of Trade Bldg. Six stys. and basement, 100 x 130. By-law carried Sept. 27th.

Stock yard, etc., cost $350,000, planned by City Council. Clerk, J. M. Miller. Interested, President Negilus, of The United Farmers of Alberta. By-law carried Sept. 27th.

Hospital, cost $30,000, planned by City Council. Clerk, J. M. Miller. Ratepayers passed by-law to raise above amount for Tuberculosis Hospital.

Dunnville, Ont.
Alterations and extension to lodge, Canal St. W., planned for L. O. L. No. 161. Sec. Bldg. Com., Chas. R. Bilger. Chairman, J. W. Holmes. Bulk or separate tenders received by Sec. until Oct. 16th. Plans and specifications from either Chairman or Secretary.

Fredericton, N.B.
School contemplated. Sec.-Treas., Chas. Simpson. Architect, F. Neil Brodie, 42 Princess St., St. John. Site on Smythe St. has been selected, 230 x 126. Plans will be prepared.

Guelph, Ont.
Prov. Govt., Dept. of Public Works, contemplate new Dormitory building to be erected for Ontario Agricultural College. Plans will be prepared.

Gaspe Basin, Que.
Public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 27th. Plans, etc., at office of Chas. Chapais, Dist. Engineer, Post Office Bldg., Quebec, Que., Post Office, Gaspe, and Dept., Ottawa.

Graham Hill, Sask.
School contemplated for Shakespeare School Dist. No. 3057. Treas., S. C. Smith, Graham Hill. Plans will be prepared.

Kingsville, Ont.
Public building. Tenders received by Secretary, Dom. Govt., Dept. of Public Works, R. C. Desrochers, Ottawa, until Oct. 27th. Plans, specifications, etc., at office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at Department, Ottawa.

Marengo, Sask.
School, cost $2,100, planned for Pizarro School Dist. No. 2984. Treas., Hugh H. McNaughton, Marengo.

Medicine Hat, Alta.
School, cost $150,255, for School Dist. No. 7. Treas., R. M. Napier. Eight rooms, brick and stone construction. Plans in progress.

Montreal, Que.
Public bath, Ontario St., planned by Board of Commissioners. Sec., L. N. Senecal. Architect, Dalbe Viau, 76 St. Gabriel St. Tenders close with Architect, Oct. 10, for General Contractor.

Fire and police station, cost $85,000, Bois de Boulogne. Architect, C. A. Reeves, 58 St. James St. Former tenders were too high, new tenders will be received by Commissioners from Oct.

13th to 23rd. Two storeys, 80 x 120. Board of Commissioners. Sec., L. N. Senecal.

Fire station, cost $85,000, Ottawa and Young, contemplated by Board of Commissioners. Sec., L. N. Senecal. Architect, D. I. Spence, 46 Beaver Hall Hill. Tenders called shortly.

Club and library contemplated for Mechanics Institute, Mr. Hamilton, St. James and St. Peter Sts. Architect not chosen. Site not yet decided on.

Neville, Sask.
School, cost $8,000, contemplated by Neville School Dist. No. 2846. Treas., A. J. Grenache. Brick veneer construction. Plans will be prepared.

Ottawa, Ont.
H. Brouse, 168 Sparks St., is seeking permission from Council to erect theatre on Bank St.

Owen Sound, Ont.
Normal school contemplated by Prov. Govt. Dept. of Education. Minister, Hon. R. A. Pyne, Toronto. Plans will be prepared.

Peace River Crossing, Alta.
School contemplated for School Dist. No. 2526. Treas., H. A. George. Building material and school equipment required.

Quebec, Que.
Heating and ventilating of post office. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 16th. Plans, etc., at offices of Chas. Chapais, Dist. Engineer, Post Office Bldg., Que., Postmaster, Que., and at Dept., Ottawa.

Sapperton, B.C.
Church contemplated for St. Mary's Congregation. Plans will be prepared.

Sorel, Que.
Post office fittings. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, will receive tenders until Oct. 14th. Plans and specifications at office of R. L. Deschamps, Overseer Public Bldgs., Post Office, Montreal, Postmaster, Sorel, Que., and at Dept., Ottawa.

Toronto, Ont.
Three schools, cost $34,000, contemplated by Scarboro Twp. Council. Clerk, Thos. Crawford, Agincourt, Ont. By-laws have passed Council and plans will be prepared.

Public lavatory, Birch Ave., N. Toronto, planned by Board of Control. Mayor, H. C. Hocken. Property Commissioner Chisholm has secured site.

Church for St. Francis Congregation (R. C.), Arthur and Grace Sts. Rev., W. A. McCann, 15 Grace St. Site secured for new building, N. E. corner Grace and Mansfield. Plans will be prepared.

Vancouver, B.C.
Addition to hospital contemplated by Vancouver General Hospital Board. Plans will be prepared.

CONTRACTS AWARDED

Bury, Que.
Drill hall, cost $11,750, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, A. Cromwell, Cookshire, Que.

Dresden, Ont.
Public library, cost $10,000, planned by Town Council (Library Board). Sec. of Board, Thos. Conway. Architect, W. A. Mahoney, Guelph. General contractor, Geo. Clark, Dresden. Mason, F. Jennings, Dresden.

Edmonton, Alta.
Fire hall and police station, cost $35,000. Mayor, Mr. Short, Civic Office. Clerk, C. Cox, Civic Offices. Architect, A. Jeffers, Civic Offices. General contractor, Owner, Construction Dept. Two storeys, 68 ft. 3 in. x 103 ft., brick construction, concrete foundation. Excavating started.

Galt, Ont.
Repairs to Town Hall. Clerk, Jos. McCartney. Roofing, Brown-Jarvis Roofing Co., 205 Colborne St., Brantford. Metallic roofing.

Little River, N.B.
Hatchery, cost $11,000, for Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston, Ottawa. General contractor, E. W. Green, Tisdale House, St. John, N.B. Concrete work, Jas. Sproul, 281 Princess St.

Montreal, Que.
Church, cost $80,000, for Fabrique of St. Francois Xavier, Longue Pte. Architects, Gauthier & Daoust, 180 St. James St., Montreal. General contractor, Jos. Fateux, Laurier and De L'Epee, will call tenders for roofing about December 1st.

Hall, cost $3,200, for C. C. Holland, 519 St. Catherine St. W. General contractor, Mr. Hill, Ritz Carleton Hotel, doing work by day labor. Alterations to interior woodwork, painting, etc.

Post office, cost $70,000, Westmount (Greene Ave.). Dom. Govt. Dept. of Public Works. Sec. R. C. Desrochers, Ottawa. General contractors, excavating and brick, Jno. Quinlan & Co., 4412 St. Catherine St. W. General contractor called for tenders for all other trades on Oct. 6th. Two storeys, 102 x 85.

Newmarket, Ont.
Isolation hospital planned by Industrial Home Commrs. of York County, J. G. Cornell, Scarboro, Ont. General contractor, W. B. Graham, 543 Jarvis St., Toronto. Will sub-let all trades except carpentry.

Ottawa, Ont.
Church for St. Peters Evangelical Lutheran Congregation. Pastor, 250 Lyon St. Architect, Hubert Shleacow, 45 Sparks Chmbrs. Mason, McDiarmid & Tyndall, 243 Flora. Carpenter, Alexander & Campbell, 587 Lisgar. Sheet metal, Wood & Co. Plastering, H. McNulty, 641 King Edward. Painting, D. Rankin & Son, 291 Sunnyside. Heating and electrical not let. Plumbing, McKinley & Northwood, Rideau Sta. Cement block construction.

Petrolia, Ont.
Citadel, cost $7,000, for Salvation Army. Major McGillivray, London. Architect, Major Miller, S. A. Headquarters, Toronto. General contractor, H. Clark, Petrolia.

St. John, N.B.
Observatory, cost $25,000, Douglas Ave., for Dom. Govt. Meteorological Service. Architect, Garnet Wilson, 50 Princess St. General contractors, British American Constr. Co., Prince William St. Foundations in.

South Edmonton Alta.
Business college, cost $10,000, Whyte. Architect, general contractor and carpenter, N. Cuthbertson, 113 8th St. S. W. Mason, Mr. Provincial, Main St. Painting, Cameron Paint Co., Namayo Ave. Heating, Reliable Plumbing & Heating Co., 544 9th St. Electrical, Burnham Frith Elec. Co., Rice St. Interior fittings, roofing and plastering not let yet. Two storeys, 33 x 68, brick construction, felt and gravel roofing.

Toronto, Ont.
Church, cost $50,000, Sunnyside, for Howard Park Methodist Church. Architect, W. G. Burns, 74 Indian Grove. Mason, H. H. Hall, 6 Park Place. Carpenter, W. A. Rumney, 886 Dufferin St. Basement only to be finished now, main building to be started in spring. 50 x 108.

Theatre, cost $8,500, 373 Yonge St., for E. Jackson, 661 Spadina ave. Architect, J. W. Sidall, Confederation Life Bldg. General contractors, Hall & Sons, 516 Manning ave. Steel, Dom. Bridge Co., Victoria St. General contractors will not sublet. Two storeys, 33 x 130. Walls started.

Welland, Ont.
Rebuilding court house, cost $1,000, East Main. Co. Clerk, R. Cooper, Welland. Inspector, J. C. Laughlin, Thorold, Ont. General contractors, Clark & Son (of Toronto), Welland. Electrical, McMurray Bros., Welland, $856.24.

Business Buildings and Industial Plants

Calgary, Alta.
Flour mill, cost $1,400,000, contemplated for Calgary Flour Mills Co., Ltd. President, O. G. Devenish, c/o O G. Devenish & Co., 813a 1st St. E. Vice.-Pres., T. M. Fyste, 605 14th Ave. W. Sec., A. W. Pryce Jones, c/o Pryce Jones (Canada), Ltd., 12th Ave. and 1st. St. W.

Flour mill contemplated for Lake of The Woods Milling Co., 212 McDermot Ave., Winnipeg. Company are looking for a favorable site and plans will be prepared.

Dundas, Ont.
Addition and alterations to drug store, King St., for Thos. H. Ralph. Architect, M. H. Hewitt. Roughcast construction. Plans in progress.

Forest, Ont.
Addition to factory planned for Forest Basket Factory. Pres., Thos. Maylor. Company will double capacity. By-law passed Sept. 29th granting exemption from taxes for 10 years.

Ingersoll, Ont.
Addition to piano factory, cost $25,000, contemplated for Evans Bros. Architect to be selected. White brick construction.

London, Ont.
Addition to garage, cost $10,000, contemplated for R. Hueston & Sons, Wellington St. Architect to be selected. One storey, white brick construction.

Mansonville, Que.
Pasteurizing plant for Lyndonville

Creamery Assn., will be installed, similar to the one in operation at Glen Sutton, Que. Manager, A. Rice, Glen Sutton.

Montreal, Que.

Store and residence, cost $12,000, St. Hubert, for Philippe Picard. Three storeys, 50 x 95, concrete foundation, felt and gravel roofing. Plans in progress.

Office building, cost $350,000, St. James near McGill, for Marcil Trust Co., 180 St. James St. Architects, E. & W. S. Maxwell, 6 Beaver Hall Square. Contractors bidding, Geo. A. Fuller Co., 210 Reid Bldg., Norcross Bros., New Birks Bldg. 10 storeys, 78 x 104.

Bank building contemplated, Maisonneuve, for Bank of Montreal, 109 St. James St. Architect not chosen. Further developments later.

Alterations to stores, Bleury St., for J. E. Wilder, 41 Major St. Plans in progress.

One store and 2 flats, cost $4,500, for Roch Lussier, 2853 St. Lawrence. Three storeys, 25 x 50, brick foundation, felt and gravel roofing. Plans ready.

North Sydney, N.S.

Stores and offices, cost $15,000, Commercial street, planned for N. A. McMillan and W. M. McCallum. Tenders received by N. A. McMillan. Two stys., brick and concrete foundation, brick construction, concrete and red facings.

Niagara Falls, Ont.

Brick manufacturing plant, cost $50,000, Victoria Ave., contemplated for John Dawson, Trustee, Huron and Welland Ave. Plant for manufacture of plain, wire cut and pressed brick. Electric power to be used. Plans will be prepared.

Ottawa, Ont.

Alterations to stores, cost $4,000, Slater, for C. B. McTaggart, 341 McLeod. Architect, W. Herbert George, Castle Bldg., Queen St. Plans drawn.

Addition to warehouse, cost $10,000, for S. J. Major, Ltd., York St. Architect, C. P. Meredith, 126 Sparks St. One storey addition, brick and reinforced concrete construction, electric lighting. Plans in progress.

Regina, Sask.

Foundations for warehouse, for Campbell Bros. & Wilson, Princess and Bannatyne Sts., Winnipeg. Architect, J. H. G. Russell, 1110 McArthur Bldg., Winnipeg. Six storeys, 103 x 108, brick and mill construction, stone trimmings, concrete foundation, electric lighting, steam heating, 3 freight elevators. Foundation will go in this year. Plans not completed for remainder yet.

St. Catharines, Ont.

Garage, cost $5,000, Queenston St., for W. C. Warren, Nelson St. Tenders received by Architect, Joseph Daw, 165 St. Paul St., until Oct. 4th. Two stys., 35 x 46, brick construction, concrete foundation.

South Dorchester Twp., Ont.

Farm buildings, cost $4,000, for Angus Taylor, Belmont P. O. Fireproof construction and roofing, concrete foundation. Plans in progress.

Toronto, Ont.

Coal shed, Dufferin and Belt Line, for Conger Leigh Coal Co., 95 Bay Street. Site purchased, 265 x 115 and plans will be prepared.

Factory, cost $40,000, planned for R. Crean & Co., 12 Balmuto St. Architects, G. M. Miller & Co., 93 Yonge St. Contracts not yet awarded. Four storeys, 50 x 132, steel and brick construction, brick foundation, felt and gravel rfg.

Gull Lake Lumber Co., Ltd., has been incorporated, H. O. Gravenhurst, Ont. Capital $100,000. Interested, F. L. Tate, 240 Dupont St.; W. R. Bird, 157 Bay St. To construct, build and operate mills for for the manufacture of the by-products of wood and timber.

Alterations to restaurant, 9-11 Richmond St., for Childs Co., Yonge & Richmond Sts., Toronto, and 200 5th Ave., New York, N.Y. Plans will be prepared.

Victoria, B.C.

Pottery plant, cost $100,000, contemplated, for British Columbia Pottery Co., 626 Pandora. General manager, A. T. Monteith. Plant was destroyed by fire, start rebuilding shortly.

CONTRACTS AWARDED

Amherst, N.S.

Store, cost $20,000, Church, for H. Hagen & Co., plumbers. General contractor, carpenter, steel and roofing, J. A. McLellan. Mason, J. N. Fage, Heating and plumbing, Owner. Two storeys, 69 x 67, brick construction.

Berlin, Ont.

Shoe factory, Kaiser St., for Gourlay & Fogelberg, Kaiser St. General contractors, Secord & Sons, Brantford. Foundations in.

Ford City, Ont.

Bank building for Merchants Bank of Canada, H. O. Montreal. Architects, Hogle & Davis, 80 St. Francois Xavier St., Montreal. General contractors, Schmeid-Sisman, 387 Beaufort Ave., Detroit, Mich.

Hamilton, Ont.

Office, cost $3,000, Wentworth St. N. Owners and general contractors, Hamilton & Toronto Sewer Pipe Co., Terra Cotta Ave. 1½-storeys, brick and hollow tile construction, concrete foundation.

Foundry, cost $125,000, Aberdeen Ave., for Canadian Westinghouse Co., Ltd. Manager, Paul J. Myler. Architects, Prack & Perrine, 3 James St. S. General contractors, H. G. Christman Co., 32 Main St. E. Two storeys, main building, 304 x 70, reinforced concrete construction.

Alterations and addition to stores, cost $15,000, James N., for M. & S. Epstein, c/o Dom. House Furnishing Co., 120 James N. Architect, W. A. Edwards, 7 Hughson St. S. General contractor, Geo. E. Mills, King St. E.

Addition to store, cost $5,000, King E., for Walter Howell, King and Emerald. Architects, Mills & Hutton, Bank of Hamilton Bldg. General contractors, Hogan & Farr, 15 Fairholt Ave.

Laundry and heating plant, cost $18,000, planned by City Council Hospital Board. Architects, Stewart & Witton, 7 Hughson St. S. Mason, W. H. Yeates, 24 Leeming St.

Alterations and addition to store, James St. N., for J. H. Aussem, James St. N. Architect, L. A. Wardell, 110 Hunter St. W. General contractors, Mitchell & Riddle, 111 Pearl St. N. Three storeys, steel and brick construction, stone foundation.

Lacombe, Alta.

Store and residence, cost $6,000, Barnett Ave., for A. M. Campbell. General contractor, Sam Watt. Plumbing, electrical and interior fittings not yet let.

Montreal, Que.

Carriage factory, cost $8,000, Albert, for J. P. Montpetit, 73a Argyle Ave. Architect, O. Dufort, 192 St. Catherines St. W. General contractor, J. Boucher, 60 St. Clodile, St. Henry. Brick, A. Leger, 41 Agnes St., St. Henry. Four storeys, 46 x 80.

Store and apartments, cost $50,000, Westmount (Greene and Sherbrooke), for Brillon & Jarry, 1185 St. Denis (Mr. Brillon). Architect, G. A. Monette, 260 St. James St., Montreal. Mason, brick and carpenter, Peel & Peel, 710 Fullum. Work has been held up but is going ahead now. Four storeys, 60 x 40.

Bank, cost $5,000, 101 St. James St., for Banque Nationale, 101 St. James St. General contractor, L. Beaudry, 2420 Hutchison.

Garage, for R. B. Angus, 240 Drummond St. Architects, E. & W. S. Maxwell, Beaver Hall Square. General contractors, Reid, McGregor & Reid, Guy Block. 30 x 30, concrete foundation, reinforced concrete, sandstone and enamelled brick construction, fireproof roofing.

Two stores and 4 flats, cost $15,000, Cote St. Paul (cor. Church and York), for Levi Jacob, 1421 Demontigny. General contractor, mason, Nap. Lavoie, 218 Bond Ave., Verdun, will receive tenders for all other trades. Three storeys, 55 x 50, concrete and stone foundation, glazed brick construction, brick cornices, felt and gravel roofing.

Factory for Prowse Range Co., 22 McGill College Ave. Architects, Wright & Son, 204 St. James St. General contractor, Robt. Neville, 11 Busby Lane. Excavating, mason and brick work, A. E. Wand, Victoria Ave., St. Lambert, Que. Four storeys, concrete foundation, steel and brick construction.

Greenhouse and conservatory, cost $25,000, for L. H. Timmins, Dom. Express Bldg., St. James St.. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, mason and brick, Reid, McGregor & Reid, Guy Block. Steel, Structural Steel Co., New Birks Bldg. Roofing, painting, heating and electricity, Pierson U-Bar Co., 10 Phillips Place. Stone foundation and construction.

Warehouse, shops and office, cost $40,000, Beaumont, for Gen. Fire Extinguisher Co., 175 McCord St. Architect, Robt. Findlay, 10 Phillips Place. General contractors, Reid, McGregor & Reid, Guy Block. Roofing, Richardson & Simard, 745 Clarke. Painting, Alex. Craig, 41 Jurors. One and two storeys, 200 x 120, concrete foundation, brick construction, felt and gravel roofing. Foundations in.

Store and 4 flats, cost $5,000, Rosemount (10th Ave.). Owner and general contractor, A. Marcotte, 545 Garnier St., Montreal. Three storeys, 25 x 40, concrete foundation, brick construction, felt and gravel roofing. Day labor.

Ottawa, Ont.

Factory, cost $27,000, Nelson St., for Crown Lithographing Co., Wellington St. General contractors, masonry and carpentry, Toms & Copeland, Arlington St. Plastering, painting and electrical not let. Foundations started.

Addition and alterations to store, cost $7,000, Rideau. General contractors, Alexander & Campbell, 587 Lisgar St. Owner, R. B. Whyte, 370 Rideau St. Architect, W. E. Noffke, Central Chambers. Solid brick construction, stone foundation.

Regina, Sask.

Stable, cost $23,900, Albert St., planned by City Council (Dr. M. R. Bow, M. H. O.). Architect, R. W. Allen, City Engineer's office. General contractors, Frid Lewis & Co., Ltd., 901 Somerset Bldg., Winnipeg. Two storeys, frame, stone and brick construction, galvanized iron roofing, electric lighting.

Addition to hotel, cost $12,000, S. Railway, planned for Palmer House, Ltd., S. Railway and Broad Sts. General contractors, McKay Construction Co., 1818 Scarth St. Will add 20 bedrooms. Two storeys, brick construction and foundation.

St. Catharines, Ont.

Factory, cost $10,000, Pamilla street, for Rice Hulbert Shoe Co., Courtland, N.Y. (L. R. Hulbert). Architect, Jos. Daw, 165 St. Paul St. Masonry, Rymer Bros., Maple St. Brick work started.

Sherbrooke, Que.

Extension to offices, cost $8,000, Wellington, for J. W. Gregoire. General contractors, Sherbrooke Construction Co. Three additional storeys, 70 x 40, steel and brick construction, asbestos roofing and plaster.

Stratford, Ont.

Addition to factory, Erie, for Canadian Gen. Elec. Co., King and Simcoe Sts., Toronto. Architect, J. S. Russell, 21 Downie St., Stratford. General contractor, J. L. Youngs, Stratford.

Toronto, Ont.

Factory, Leaside, for Canada Wire & Cable Co., 1170 Dundas St., Toronto. General contractor, Owner. Main building, 3 storeys, 100 x 200, mill and brick construction, steel sash, felt and gravel roofing. Extension to main building, 1 storey, 200 x 500, steel frame construction.

Store and residence, cost $6,000, 1069 Bathurst. General contractor and mason, J. Burford, 14 Vermont. Will sub-let some trades. Three storeys, 24 x 60, brick construction, stone foundation.

Walkerville, Ont.

Store and flat, cost $6,000, Lincoln Rd., for Fred Laforet. Architects, Smith & Walker, Excise Bldg. Mason, H. Howe, Walkerville. Carpenter, J. J. Miller. Iron and steel, Canadian Bridge Co. Heating and plumbing, Jas. Purse, 30 Glengarry Ave., Windsor. Store fronts. Foundations in.

Winnipeg, Man.

Store, cost $5,000, Burnett & Ellice, for E. A. Whatley, Spence & Ellice. Architect, D. W. Bellhouse, 7th Floor Canada Block. General Contractors, Fred Lewis & Co., 901 Somerset Bldg. One storey and basement, pressed brick construction, stone and concrete foundation. Excavating started.

Store, cost $4,000. Owner and general contractor, E. A. Whatley, Spence and Ellice. Architect, D. W. Bellhouse, 703 Canada Block. One storey, brick construction, concrete foundation.

Office building, cost $860,000, Garry and Ellice. Prudential Trust, Limited. Architects, Ross & MacDonald, 928 Union Bank Bldg. General contractors, Geo. A. Fuller Co., Ltd., 1001 Union Bank Bldg. Foundations will go in this year.

Addition to hotel, cost $15,750, for J. J. O'Connell, 322 Nairn Ave. Architect, C. S. Bridgeman, 20 Canada Life Bldg. General contractor, W. J. Wilson, c/o Architect. Three storeys, 40 x 40, frame construction, concrete foundation. Excavating done.

Office, Main St., for Merchants Bank of Canada. Architects, J. D. Atcheson & Co., Trust & Loan Bldg. General contractors, Geo. A. Fuller Co., Union Bank Bldg. Walls started.

Residences

Brampton, Ont.

Rectory, John St., contemplated for St. Mary's Congregation. Site purchased, 60 ft. frontage and plans will be prepared.

Fort William, Ont.

The Colonial Realty & Securities Corporation Ltd., Lumsden Bldg., Toronto, Ont., contemplate purchase of land in North End of City, and will commence operations shortly on the erection of 100 residences.

500 workmen's homes, Western Limits, contemplated by a Syndicate. Interested, Mr. D. Walker, Leeds, England. Houses to cost about $1,500 each, work to start shortly.

London, Ont.

Residence, cost $7,000, contemplated for Hubert Ashplant, 462 King St. Architect to be selected. Two storeys, hollow tile and red pressed brick construction, stone and concrete foundation.

Residence, cost $5,000, contemplated for Geo. C. Raymond, 195 Wharncliffe Rd., South London. Architect to be selected. Two storeys, red pressed brick construction, stone and concrete foundation, shingle and slate roofing.

Residence, cost $4,000, for N. S. Roberts, 83 Dundas St. Two storeys, red pressed brick construction, concrete foundation. Plans in progress.

Montreal, Que.

Residences, cost $15,000, Outremont (Bloomfield), for A. Racine & A. Gravel, 1549 Blvd. Gouin. Architect, Z. Trudel, 1075 Cartier St. Three storeys, 60 x 76, cement foundation, brick construction. Plans ready.

Toronto, Ont.

Residence, cost $3,500, for D. Baker, 34 Jackman Ave. 2½-storeys, 20 x 42, brick construction and foundation. Plans drawn.

One detached residence, cost $3,000, Edgewood Grove, for A. T. Fox, 111 Edgewood Ave. Tenders received by owner. 2½-storeys, 22 x 40, brick construction and foundation.

Winnipeg, Man.

Residence, cost $45,000, Fort Garry Drive, for Col. R. M. Thomson, c/o Architect. Architect, C. W. U. Chivers, Keewayden Bldg., Portage Ave. E. 2½-storeys. Plans in progress.

CONTRACTS AWARDED

Brandon, Man.

Five cottages, cost $20,000, Lunatic Asylum, planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Colin H. Campbell, Winnipeg. Architect, V. W. Horwood (Prov. Architect), Winnipeg. General contractor, J. Clark, Brandon. Sub-Contractors, Beaver Bldg. Co., 44 Clement Block, Brandon. One storey, 27 x 40, frame construction, concrete foundation, electric lighting.

Residence, cost $4,650 Lunatic Asylum, for Prov. Govt. Dept. of Public Works. Minister, Hon. Colin H. Campbell, Winnipeg. Architect, V. W. Horwood (Prov. Architect), Winnipeg. General contractor, J. Clarke, Brandon. Sub-Contractors, Beaver Bldg. Co., 44 Clement Block, Brandon. 1½-storeys, 28 x 40, frame construction, concrete foundation.

Calgary, Alta.

Apartment block, cost $20,000, for O. G. Anderson, 1215 12th Ave. W. Architects, Burroughs & Richards, 11 Crown Block General contractor, Supt. A. P. Hindleman. Two storeys, 100 x 40, brick veneer construction. Excavating done.

Edmonton, Alta.

Residence, cost $7,000, 26th. Architect and general contractor, C. R. Horne, 1700 24th St. Two storeys, 26 x 44, brick construction, concrete foundation. Excavating started.

Hamilton, Ont.

Five residences, cost $10,000, Cumberland Ave., for T. Carleton, Main and Spadina Ave. General contractor, W. H. Bryant, 18 Clyde Ave. Brick construction, stone foundation.

Montreal, Que.

Residence, cost $11,200, Caston, for J. R. Colby. Architects, Peden & McLaren, 20 St. Alexis, Montreal. General contractor, masonry, carpentry, steel and painting, J. J. Kirkpatrick, Montreal W. Plastering, A. Leger, 96 4th ave. Elec., Mr. Gregory. Heating and plumbing, Mr. Bain. Tenders for roofing close with general contractor Nov. 1st. 2½ storeys.

Two cottages and 3 flats, cost $20,000, Outremont (Querbes). Owner and general contractor, P. Guidazio, 327 Querbes St. Two storeys, 25 x 38, solid brick construction, felt and gravel. Foundations started.

Three flats, cost $4,000, Chestnut, for C. A. DeRepentigny, 63 Geo. Etienne Cartier. General contractor, Owner. Day labor. Three storeys, 25 x 53, felt and gravel roofing. Foundations in.

Residence, cost $7,000, Outremont (Durocher St.). Owner and general contractor, P. Guidazio, 327 Querbes St., Outremont. Architect, Z. Trudel, 238 St. Andre St. Painting, G. Taillefer, 412 Delisle. Three storeys, 25 x 85, stone foundation, pressed brick construction, felt and gravel roofing.

13 flats, cost $8,000. Owner and gen-

(Continued on page 74)

eral contractor, A. Piche, 524 Casgrain. Three storeys, 67 x 40, concrete foundation, felt and gravel roofing.

Montreal West, Que.

Residence, Ainslie Rd., for L. A. Mosher, c/o Imperial Wire & Cable Co., Guy St. Architect, W. J. Carmichael, Bell Telephone Bldg. General contractor, E. W. Barnes, 188 Wolsley Ave., Montreal W. Brick and concrete foundation, brick construction. Excavating started.

Niagara Falls, Ont.

Residence and office, cost $9,000, for Dr. S. McCallum, Huron St. Architect, Wm. Geo. Burns, 74 Indian Grove Ave., Toronto. General contractor, John Blair, Niagara Falls. 2½-storeys, 40 x 50, brick construction. Foundations in.

Ottawa, Ont.

Residence, cost $7,500, Echo Drive, for S. T. Bastedo, Trafalgar Bldg., Bank St. General contractors, Geo. Eaman & Son, Isabella St. Brick veneer and stucco construction, stone foundation.

Quebec, Que.

Residence, cost $6,000, St. Patrick St., for Eugene Dube. General contractor, Jos. Breton, 175 St. Olivier St. Four storeys, 43 x 30, concrete, wood and brick construction, iron and asbestos roofing.

Residence, cost $8,000, 35 St. Cyrille, for Simeon Poulin, 101 Richelieu. Architect, O. Legare, 234 Massue. General contractors, Ideal Constr. Co., Ltd., 224 Massue, does all work. Three storeys, 33 x 33, concrete foundation, frame and Scotch brick construction, galvanized iron roofing. Excavating done.

Three residences, cost $9,000, Limoilou (7th St.), for Cote & Frere, 7th St. and 2nd Ave., Limoilou. Architect, general contractor and carpenter, O. Cote, 79 7th St., Limoilou. Other trades not yet awarded. Three storeys, 75 x 30, stone foundation, frame and red and Scotch brick construction, galvanized iron and asbestos paper roofing.

Residence, cost $10,000, Limoilou (cor. 3rd Ave. and Beauport Rd), for Nap. Bergeron, 792 St. Valier St., Que. General contractor, Edm. Bouchard, 234 Prince Edward. Three storeys and basements, 75 x 32, wood and brick construction, iron and asbestos roofing.

Flats, cost $14,000, St. Cyrille St. Owner and general contractor, E. G. Brochu. Day labor. Three storeys, 69 x 36, stone or brick construction, iron and asbestos roofing.

South Edmonton, Alta.

Residence, cost $9,000, 3rd Ave. N., for Mrs. B. C. Fraser, 450 1st Ave. N.E. General contractor, J. S. Fraser, 450 1st Ave. Two storeys, 38 x 47, frame construction, concrete foundation.

Toronto, Ont.

Two pair and 1 detached residences, cost $13,000, Browning Ave. Owner and general contractor, C. Coldwell, 583 Carlaw Ave. Owner superintending construction. Two storeys, 33 x 42, brick construction and foundation.

One detached residence, cost $5,000, 35 Spadina. Owner and general contractor, A. E. Armstrong, 61 Farnham, will sublet. 2½-storeys, 28 x 36, brick construction, stone foundation.

Residence, cost $8,000, St. Clair Ave. W., for Dr. T. G. Phillips, 61 Yorkville Ave. General contractor, Jas. Crang, 906 St. Clair W. Will sub-let. Brick construction and foundation.

Walkerville, Ont.

Six 2-family flats, cost $30,000, Devonshire Rd., for Walkerville Land & Bldg. Co. Architects, Smith & Walker, Excise Bldg. General contractors, carpenter and roofing, Schmied-Sisman, 387 Beaufort Ave., Detroit, Mich. Plumbing, Otto Schmied, 344 Hendricks, Detroit, Mich. Electrical, W. A. Richards, Walkerville. Plastering, Jack Reid, Goyeau St., Windsor. Two storeys, 45 x 24, hot air heating.

Residence, cost $14,000, Kildare Road, for Wm. Grant, c/o Parke, Davis & Co. Architects, McFarlane, Maul & Lantz, Wayne Bank Bldg., Detroit, Mich. Mason, H. Howe, Walkerville. Iron and steel, Canadian Bridge Co. Carpenter, roofing, painting, heating, plumbing, electric and interior fittings not let. Two storeys, 58 x 54.

Winnipeg, Man.

Two residences, cost $3,000 each. Architects and general contractors, Hadley & Fidoe, 376 Atlantic Ave. One-storey, frame construction, concrete foundation, shingle roofing. Excavating started.

Residence, cost $4,000. Architects and general contractors, J. McDearmid & Co., 704 Canada Bldg. 2½-storeys, frame construction, stone foundation, shingle roofing. Excavating done.

Two residences, cost $5,500 each. Architect and general contractor, M. Sightburn, 307 Union Trust Bldg. Two storeys, frame construction, stone foundation. Excavating done.

Terrace of residences, cost $8,000. Owners and general contractors, Cohen & Rosenblat, 498 Alfred St. Architect, Mr. Blankstein, 450 Dufferin Ave. Two storeys, brick veneer construction, stone foundation.

Residence, cost $5,000. Architect and general contractor, W. Burnhard, 677 Main St. Two storeys, frame and brick veneer construction, stone foundation. Excavating done.

Residence, cost $5,000, Ethelbert. Owner and general contractor, E. Russell, 890 Ida Ave. Two storeys, 29 x 28, frame construction, stone foundation. Excavating done.

Residence, cost $10,000. Architect and general contractor, N. T. Wallace, Suite , Lincoln Apts. 2½-storeys, brick veneer construction, concrete foundation. Excavating started.

Power Plants, Electricity and Telephones

Charlottetown, P. E. I.

Street railway system contemplated for Maritime Telegraph & Telephone Co., Ltd., 88-92 Hollis St., Halifax, N.S. General manager, J. H. Winfield, c/o Company.

Elmira, Ont.

Hydro-electric plant planned by Town Council. Clerk, J. H. Ruppel. Engineer, Mr. Surtee. Machinery being installed by Geo. Klink.

Estevan, Sask.

Standard street lighting system, cost $46,000, planned by Town Council. Sec.-Treas., P. J. Stephens. By-law passed Sept. 23rd.

Hamilton, Ont.

Gas mains planned by National Natural Gas Co. Representative, R. F. Miller, Bank of Hamilton Bldg. Ratepayers will vote on by-law Oct. 10th re giving franchise to above company to supply city with gas at 37½c. per 1,000 ft. If by-law carries Company is to lay 7½ miles of mains in the city before January, 1915. All work to be done to the satisfaction of City Engineer, A. F. Macallum. Mains, valves, regulators, pipe, etc., will be required.

London, Ont.

Addition to sub-station planned for Hydro-electric Power Commission. Chairman, Philip Pocock. Architect, H. J. Glaubitz. Additional lighting and power transformers, etc., to be installed. Reinforced brick construction, concrete foundation.

Montreal, Que.

Dam and water power development planned by Southern Canada Power Co., Ltd., c/o C. J. McCuaig, 17 St. Sacrament St. Water power purchased and company is expected to supply electricity for Drummondville, Que.

Addition to telephone exchange, cost $52,500, Hospital St., for The Bell Telephone Co. of Canada. Architect, W. J. Carmichael, c/o Owner. Work will not be started until spring. Tenders called later. Two storeys, 145 x 148.

Smithers, B.C.

Work will be started soon on an electric lighting plant and water plant for J. L. Hamilton and J. Fraser. Site has been selected.

Toronto, Ont.

Sub. station planned for Toronto Hydro-electric Commsn., 226 Yonge St. Site secured at Coxwell and Rhodes for sub-station to supply power for Danforth and Gerrard Civic street car lines.

West Hamilton, Ont.

Street lighting planned for Dundas Hydro-electric Commission. Chairman, R. W. Karch, Dundas. 30 or 40 100 watt tungsten street lights to be installed.

Winnipeg, Man.

Gas testing euipment planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Equipment for 1 central and 2 branch gas testing stations. Specifications at office of Engineer. Tenders received by Board till October 8th.

Transformers required by Transcona Board of Control. Sec. M. Peterson. Engineer, J. G. Glassco, 50 King St. Three 600 kv.a. single-phase, step down transformers. Specifications at office of Engineer. Tenders received by Board of Control till Oct. 16th.

Business Notes

Gananoque, Ont.

Factory of The Spring & Axle Co., King and Pine St. burned. Damage $50,000, covered by insurance.

Montreal, Que.

School "St. Clements," Maisonneuve

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Kingsville, Ont.," will be received at this office until 4 p.m., on **Monday, October 27, 1913**, for the construction of a Public Building at Kingsville, Ont

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Kingsville, Ont.; at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Cor. Yonge and Charles Streets, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 1st, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48549. 41-42

Sealed tenders addressed to the undersigned, and endorsed "Tender for Breakwater at Kincardine, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the construction of a Breakwater at Kincardine, Bruce County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of H. J. Lamb, Esq., District Engineer, Windsor, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Kincardine, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46683. 41-42

Debentures for Sale

$17,935.98. Town of Pembroke 4½ per cent. Bonds. Viz.:—

$8,500 for extension of waterworks system, maturing 20 years from September 6th, 1912, interest payable annually at Bank of Ottawa, here.

$5,000 for bonus to manufacturing industry, payable in 20 annual instalments from February, 1913.

$4,455.98 for local improvements, due in ten years from July, 1913, interest payable annually.

Offers for the purchase of above debentures, including accrued interest, addressed to W. H. Bromley, Esq., will be received up to October 15th. Delivery of Bonds at Bank of Ottawa here.

A. J. FORTIER,
Town Clerk.

40-41

TO ARCHITECTS

Masonic Temple, Toronto

Competitive designs for the above will be received up to noon on the **20th day of January, 1914**. The conditions of competition have been prepared by a competent professional adviser who will also report upon the merits of the various designs. For copy of Conditions apply to Mr. W. H. Best, No. 181 Avenue Road, Toronto. 40-41

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Thornbury, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the Harbour Improvements at Thornbury, Grey County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. H. Armstrong, Esq., District Engineer, Midland, Ont., and on application to the Postmaster at Thornbury, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47674. 41-42

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to 2 p.m. on **Monday, October 27th, 1913**, for the digging and construction of the Bowes Award Drain in the Townships of Hullett and Morris.

Plans and specifications can be seen at the Clerk's office, Londesboro, Ont.

The lowest or any tender not necessarily accepted.

JAMES CAMPBELL,
Township Clerk

41-42

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Wellington, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the construction of Harbour Improvements at Wellington, Prince Edward County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Wellington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation, and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46393. 41-42

TENDERS

Separate or bulk tenders addressed to the undersigned will be received up to and including **Friday noon, October 24th, 1913**, for the construction of the new Young Men's Christian Association building, St. Thomas, Ontario.

Plans and specifications can be arranged for and seen at the office of architect.

The lowest or any tender not necessarily accepted.

JOHN T. FINDLAY, Architect,
41 St. Thomas, Ont.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **October 9th, 1913**, for the construction of the following work:—

Midway Sewer System, Outlet Via Hiawatha Ave., Gerrard Street and Morley Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, Sept. 30th, 1913. 41

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Business Notes

(Continued from page 73)

(Lafontaine St.), owned by R. C. School Board, burned; loss $150,000. Rev. Pere Contant, Chairman. Some insurance.

Ottawa, Ont.

Store and residence owned by Joseph Durocher, Eastview, Ont., burned. Loss $8,500. Will rebuild. Brick veneer construction, concrete foundation, felt and gravel roofing, store fronts and fixtures.

Miscellaneous

Coquitlam, B.C.

Fire alarm system, cost $15,000, contemplated by Town Council. Clerk, J. Smith.

Montreal, Que.

Fire-Chief Tremblay has advised the Board of Control to equip him with motor fire fighting apparatus for four of the down town stations. Sec., L. N. Senecal.

Ottawa, Ont.

Ice breaker, cost $750,000, for Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston. General contractors, Vickers' Sons & Maxim, London, Eng. To operate between Montreal and Quebec.

Toronto, Ont.

Fire alarm apparatus. General contractors, Star Electric Co., Binghampton, N.Y. 10 circuit protection board, 8 circuit storage battery board, motor generator set, 150 cells, storage battery, 12 alarm boxes, etc., $3,774.

Winnipeg, Man.

Fence, cost $2,644.85. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. J. Carruthers, 127 Edmonton St., for material and labor. Board of Control. Sec., M. Peterson.

New Companies

Huronia Beach Resort Company, Limited, has been incorporated with a capital of $250,000 to erect buildings and deal in building materials, with head office at Toronto. The provisional directors are G. H. Gray, J. J. Gray, barristers, and W. R. Willard, law student, all of Toronto.

Co-Operative Brick Company, Limited, has been incorporated with a capital of $1,000,000 to manufacture and deal in brick and building materials, with head office at Toronto. The provisional directors are J. G. Shaw, Jos. Montgomery and B. E. Bull, barristers, all of Toronto.

The Interprovincial Engineering and Contracting Company, Limited, has been incorporated with a capital of $75,000 to carry on business as contractors and manufacturers of building material, with head office at Toronto. The provisional directors are J. T. Jackson, Samuel Jackson, mechanical engineers, and C. E. Howard, broker, all of Toronto.

Gull Lake Lumber Company, Limited, has been incorporated with a capital of $100,000 to erect saw mills and carry on business as lumber manufacturers and dealers in wood products, with head office at Gravenhurst, Ont. The provisional directors are T. H. Wilson, W. H. Ford, barristers, F. L. Tate, bank manager, and W. R. Bird, estate agent, all of Toronto.

Toronto Freehold Lands, Limited, has been incorporated with a capital of $40,000 to carry on business as general contractors and builders, with head office at Toronto. The provisional directors are J. H. A. Blair, Irene Rouse and Marion Forsythe, stenographers, all of Toronto.

Lonsdale Park, Limited, has been incorporated with a capital of $750,000 to carry on business as a general land and building company, with head office at Toronto. The provisional directors are L. F. Black, accountant, H. A. Hall and J. J. Flint, bookkeepers, all of Toronto.

The Pembroke Realty Company, Ltd., has been incorporated with a capital of $100,000, to manufacture brick, lime, gravel, lumber or other building material, with head office at Pembroke. The provisional directors are J. F. Munro, T. H. Moffat, contractors, and E. A. Dunlop, merchant, all of Pembroke, Ont.

The Merritt Lumber Company, Ltd., has been incorporated with a capital of $20,000, to manufacture and deal in lumber and other forest products, to open up timber limits, etc., with head office at Sudbury. The provisional directors are J. S. McKessock, J. H. Clary, solicitors, and Colin Argyle Campbell, recorder, all of Sudbury.

Late News Items

Edmonton, Alta.

Store, cost $3,000, Syndicate. Architect and general contractor, J. A. McBurney, 1335 26th street. One storey, 33 x 50, frame and brick veneer construction. Foundations in.

London, Ont.

Apartment, cost $35,000, Queens ave., for Dr. H. A. Kingsmill, cor. Queens and Park ave. Architect, W. G. Murray, Dom. Savings Bldg. General contractor, Harry Hayman, 491 Ontario Street. Five storeys, brick construction. Excavating done.

Montreal, Que.

Flats, cost $5,000, Verdun, for Mr. Lalonde, c/o D. Lanthier, 1332 Wellington street, architect and general contractor, who will do all work by day labor.

Three flats, cost $6,000, Hutchison, for

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220 King Street West - TORONTO

Miss Irene Provencher, 135 Mansfield. Architect, Alp. Charbonneau, 27 Casgrain St. General contractor, owner, day labor. Three storeys, 25 x 75, stone foundation. Permit issued.

Six flats, cost $5,000, Cartier, planned for Jos. Chevalier, 140 St. Jerome. 3 storeys, 25 x 45, concrete foundation, felt and gravel roofing. Permit issued.

Ottawa, Ont.
Waterworks supplies required by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. (a) Gaskets, bolts, nuts and rivets (will buy in open market) (b) Sluice gates, etc., T. Lawson & Sons, Wellington Street.

Port Arthur, Ont.
Market building contemplated by the City Council. Clerk, T. F. Milne. Purchase of site is being considered and plans will be prepared.

Robertson, Que.
Geo. Rousseau intends rebuilding saw mill immediately. Machinery required.

St. John, N.B.
Pavements and sidewalks, cost $13,000, Sydney street and Marsh Road, planned by the City Council. Commissioner, Miles Agar.

Bank, cost $20,000, Main street, for Royal Bank of Canada. Manager, J. B. Blair, King street. Architect, K. G. Rea, Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke Street.

Sherbrooke, Que.
Hospital extension, cost $20,000, for Sherbrooke General Hospital. General contractors and architects, Loomis, Dakin, Limited. General Hospital fittings required. Excavating done.

Toronto, Ont.
Sewer planned by Board of Control. Mayor, H. C. Hocken. General contractors, J. H. M. McKnight Constructing Co., 88 St. David St. Earlscourt Drainage System No. 3 Outlet $21,738. General contractors, The Grant Constructing Co., 50 Front St. E., Dufferin Street north of St. Clair, $11,500.

School, etc., cost $125,000, Brunswick ave., for Loretto Abbey, Wellington St. W. Architect, N. G. Begg, Cosgrave Bldg. Mason, M. Manley, 1058 College St. Carpentry, T. J. Sullivan, 552 Ontario St. Steel, Reid & Brown, Esplanade. Painting, J. J. O'Hearn, 249 Queen St. W. Ornamental iron, Dom. Ornamental Iron Co., 1195 Queen St. East. Foundations started.

Machine shop, cost $10,000, Sherbrooke, Owner and general contractors, Toronto Railway Co., King and Church streets. Two storeys, 24 x 80, steel and brick construction, brick foundation.

Asphalt pavements planned by Board of Control. Mayor, H. C. Hocken. General contractors, Godson Contracting Co., Manning Chambers. Rhodes ave., $14,891; Marchmont Rd., $4,947; St. Clair ave., $15,499; Elmer ave., $5,794; Morley ave., $19,908. General contractor, Constructing & Paving Co., Confederation Life Bldg., Ellerbeck, Erindale and Fulton ave., $23,972.

One detached residence, cost $7,000, Oakmount, for J. M. Heale, 307 Lumsden Bldg. 2½ storeys, 28 x 36, brick construction and foundation. Plans drawn.

Three attached stores and residences, cost $10,000, for G. N. Ferrier, 302 Danforth ave. Architect, P. H. Finney, 79 Adelaide St. E. Separate or bulk tenders received by owner until Oct. 8th. Three storeys, 75 x 60, steel and brick construction, brick foundation.

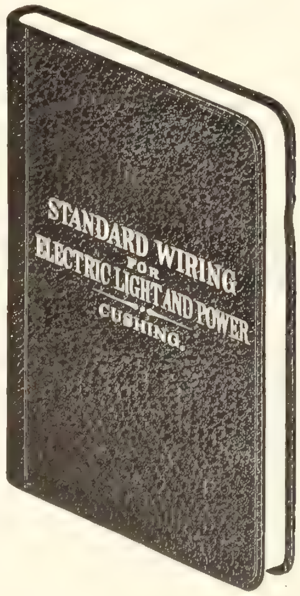
Garage and billiard room owned by Granite Club, 513 Church St., burned. Tenant of garage, The Gibson Electric Co., 517 Church St. Seven English billiard tables destroyed. Main club rooms damaged by water. Loss $65,000.

Victoria, B.C.
Residence, cost $17,000, for Wm. Wallace Blair. General contractor, A. H. Mitchell, 2618 Roseberry. Two storeys and basement, 9 rooms, frame construction.

Winnipeg, Man.
Fence, cost $2,644.85. Engineer, H. N. Ruttan, 223 James ave. General contractor changed from J. J. Carruthers to J. W. Astley, Engineer of Construction. Board of Control, Secretary, M. Peterson.

Residence, cost $4,000, Dudley avenue. Architects and general contractors, Smith Construction Co., Kennedy Bldg. Frame construction, stone foundation, shingle roofing. Excavating started.

Yorkton, Sask.
Implement warehouse, Broadway, owned by Massey Harris Co., Ltd., burned. Loss $6,500.



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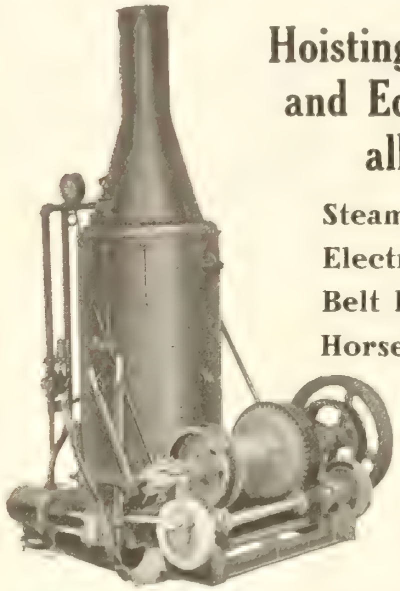

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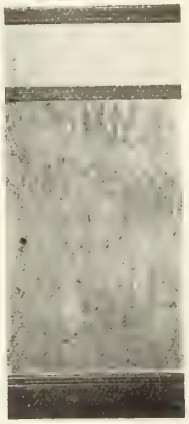

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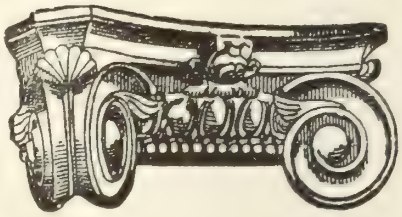

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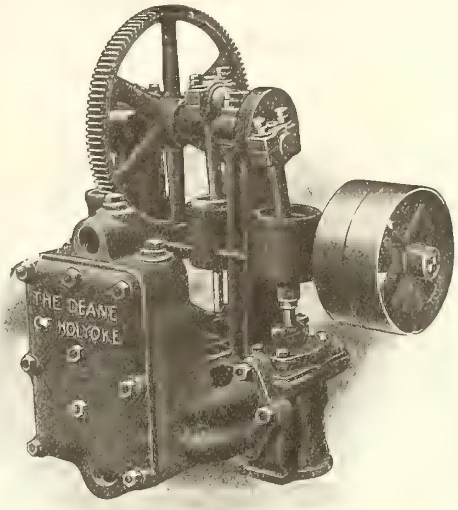

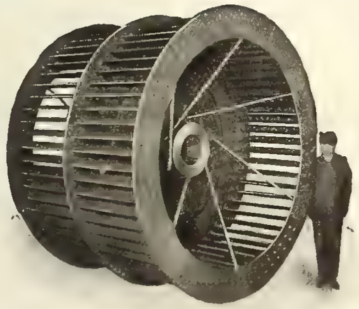

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A "Sirocco" Fan will deliver more air with less power than the ordinary steel plate fan twice the size.

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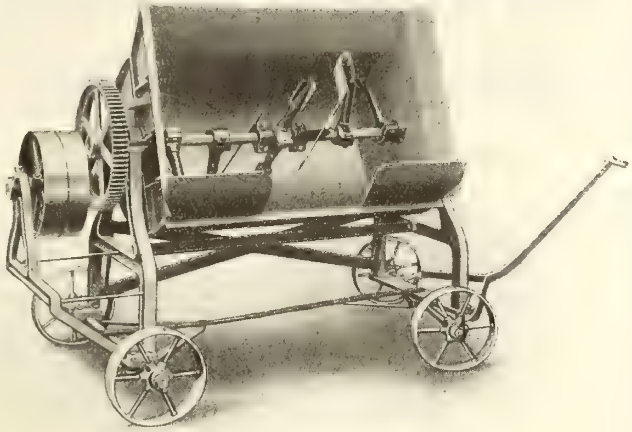

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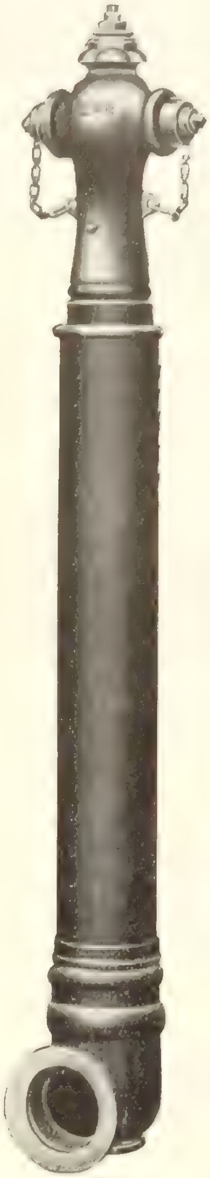

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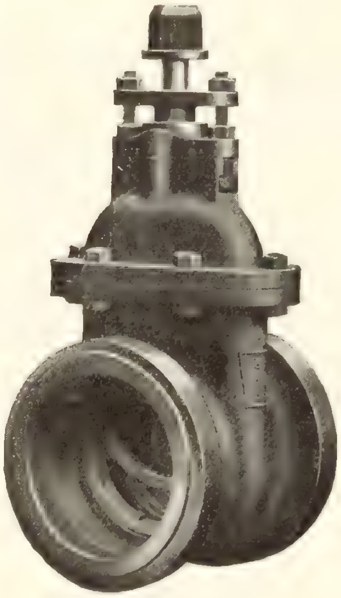

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See Bulletin 1441

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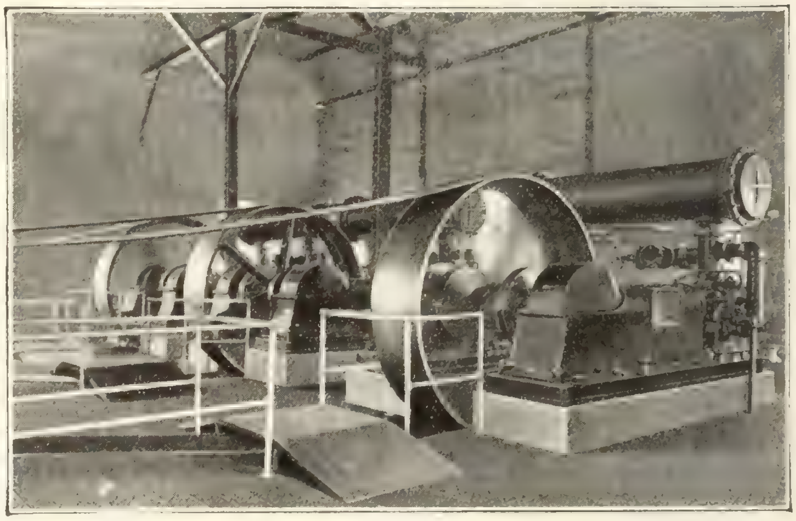

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Manufacturers of:—Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Wheels.

Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

Works: Toronto, Bridgeburg, Stratford, Montreal

EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

Toronto Representatives: Black Building Supply Co., Mail Building
Montreal Representative: E. F. Dartnell, No. 8 Beaver Hall Square
Gorman, Clancey & Grindley, Agents, Calgary and Edmonton, Alberta

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Honest Intent!

is shown by Architects specifying

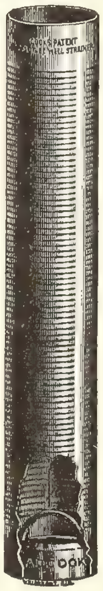
Dark Hollow Gray

Bedford Stone

BLOCKS ***SAWED***
PLANED ***TURNED***

The Consolidated Stone Company

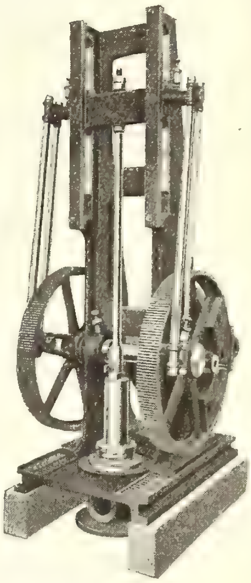
BEDFORD, Ind.



Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.

Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.



A. D. COOK

Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

CATALOGUE MAILED UPON REQUEST.

Dietrich LIMITED

Plumbing and Heating Systems

for all types of large buildings such as factories, office buildings and warehouses.

In this connection we are prepared to undertake the design and installation of such systems, putting emphasis on the fact that by "design" we mean the **correct determination of the most efficient system for the particular use under consideration.**

Dietrich LIMITED

300 Read Bldg.
Montreal

Read those underlined words over again,—they are full of importance.

Dietrich LIMITED

NATIONAL PIPE & FOUNDRY CO., LIMITED

WATER WORKS CONTRACTORS

MANUFACTURERS OF

WOODEN WATER PIPE

For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

WRITE FOR INFORMATION

802 McGILL BUILDING, MONTREAL Works: ALEXANDRIA, ONT.

The Maritime Bridge Company, Limited

Successors to

Wm. P. McNeil & Company, Limited

Manufacturers of

Bridges—Steel Buildings
Roof Trusses—Turntables
Towers—Girders and
Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, **New Glasgow, N. S.**

MR. CONTRACTOR!

Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

SAND & SUPPLIES, LIMITED

Phones: Adelaide 1947-1948

SPADINA AVE. DOCK, - TORONTO
AYR, - ONTARIO

JAMES THOMSON, President. J. G. ALLAN Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.

LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

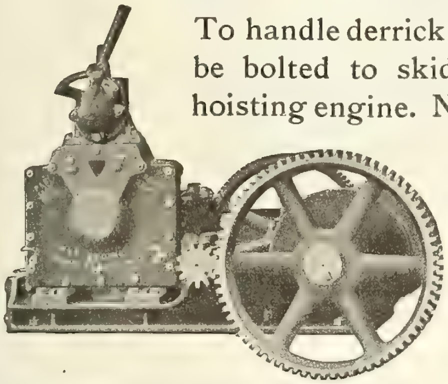
HAMILTON, ONT.

The Canada Iron Corporation, Limited

Head Office:
Mark Fisher Building
MONTREAL

Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The Dake Swinging Gear



To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

Start, Stop, Reverse at Will

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Dake Engine Co.
Grand Haven, Mich.

When you want stone that appeals specify

"Queenston Blue" Limestone

Send us your specifications for Cut Stone work

The Queenston Quarry Co., Ltd.
ST. DAVIDS, ONT.

ROCALITE

The Ready Mixed
Hard Wall Plaster

Manufactured by

Alex. Bremner
Limited
100 Bleury Street - - MONTREAL

"Galvaduct" and "Loricated"

Conduits

for Interior Construction

Conduits Company, Limited
Sole Manufacturers under Canadian and U. S. Letters Patent
Toronto - Canada

CAWTHRA MULOCK, President - - GORDON F. PERRY, General Manager

NATIONAL IRON WORKS, Limited

LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments
Offices, Works and Docks, TORONTO

Protect Your Buildings As Well as Insure Them!

Prevention of fires is vastly better than the partial redress which is all the best Fire Insurance Policy can give you. This prevention is easily secured by using

Asbestocement Building Materials

TRADE MARK
ASBESTOSLATE
ASBESTOS SHINGLES

make roofs that are handsome, *fireproof,* practically everlasting and moderate in price.

Linabestos Building Board
prevents inside fires from spreading. It is quickly applied, and gives a permanent, attractive, yet inexpensive interior finish.

Asbestos Corrugated Sheathing
makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely ***weather and fire proof.***

You build for all time when you build in Asbestocement.

Write for Booklet **C. R.** and state in which products you are particularly interested.

Asbestos Mfg. Co., Limited
Address—E. T. Bank Bldg., 263 St. James St.
MONTREAL
Factory at Lachine, P.Q. (near Montreal)

Goold, Shapley & Muir Co.
Limited
Brantford Winnipeg Regina Calgary

Towers and Tanks for all purposes.

Concrete Mixers

Gas and Gasoline Engines

Hoists

Windmills

Water supply outfits of every description.

CORRESPONDENCE SOLICITED

Contractors and Builders

Get a
300 to 500 Per Cent Guaranteed Saving

Actual Results Guaranteed or No Sale
Used Wherever Electricity is Available

The
"Hutchinson Combination Woodworker"

is particularly adapted for the following everyday work in any carpenter shop or building under construction. Cutting Studs, Rafters, Braces, Boring for Dowelling, Tenoning, Dadoing, Pulley Stiles, Window Sills and Door Jambs, Routing, Stair Stringers, Mitreing of any kind, Tool Grinding, etc., and can be set to suit any of these purposes in one minute, and once set will do as much work in an hour as a carpenter will do in a day.

A Portable Woodworker for use wherever wood is to be part of the construction. Allows more work to be done with fewer skilled carpenters. Saves money from the day it starts. Costs only $2 or $3 a month for power.

WRITE FOR CIRCULAR

M. HUTCHINSON
1007 Eastern Ave., Toronto, Ont.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Argenteuil Granite Co., Limited

42 Craig Street West, MONTREAL

We are in the market to bid on your plans for granite on buildings.

Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

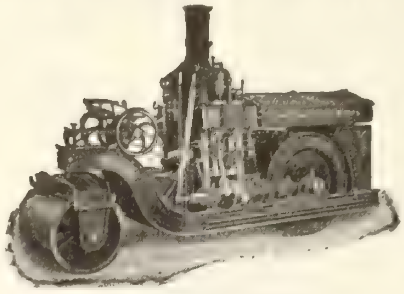
SEND US BUILDING PLANS TO-DAY

DECARIE INCINERATORS

THE ONLY SYSTEM THAT HAS STOOD THE TEST OF YEARS IN THE SANITARY AND ECONOMICAL DISPOSAL OF REFUSE

DECARIE INCINERATOR CO
MINNEAPOLIS MINNESOTA

ERIE MACHINE SHOPS



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P. W. DIETLY
Proprietor

Send for our Catalogue of Asphalt Rollers and Mixers.

1303 PEACH STREET - ERIE, PA.

County Academy, Sydney, N.S.

Butler and McDonald
St. John, N.F.

This building is sound-proofed with

CABOT'S DEAFENING "QUILT,"

"the most perfect deadener made." Not a mere felt or paper, but a thick, quilted cushion which absorbs and dissipates the sound-waves. Proof against moths, vermin and decay, and uninflammable.

Special book on School-house deafening, with twenty plates of buildings, and samples of Quilt, sent on request, free.

SAMUEL CABOT, Inc., Sole Manufacturers
BOSTON, MASS., U.S.A.

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A. Muirhead Co., Toronto.
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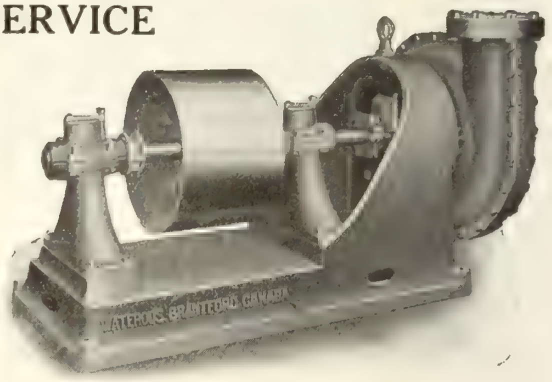
Seymour & Co., Montreal.
Can. Equipment & Supply Co., Calgary and Edmonton.
F. A. Gillis & Company Halifax and Sydney.

FOR EVERY SERVICE



WATEROUS PUMPS

Strength, simplicity and durability are Waterous Pump features. They are specially adapted for general contracting work

They will not clog up, cannot get out of order, will run every minute of a ten hour day, and can be left in charge of an unskilled laborer.

Built in capacities up to 700 gallons per minute, in Vertical and Horizontal types.

Ask for Bulletin No. 200

The Waterous Engine Works Co.
Limited
Brantford, Canada

"A MOST INGENIOUS AND USEFUL DEVICE"
—Furnishing World

Invaluable to—
Piano Manufacturers
Furniture Manufacturers
Case Goods Manufacturers
Architects and Builders

Neat and Strong
Write for Booklet

SOSS INVISIBLE HINGE CO., LTD
104 Bathurst St., TORONTO

Vault Doors and Safes

J. & J. Taylor
Toronto Safe Works
Established 1855 TORONTO
Branches : Vancouver and Winnipeg
Montreal

STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal, 5,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly. Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
Main Office and Works, Montreal

Engines and Boilers

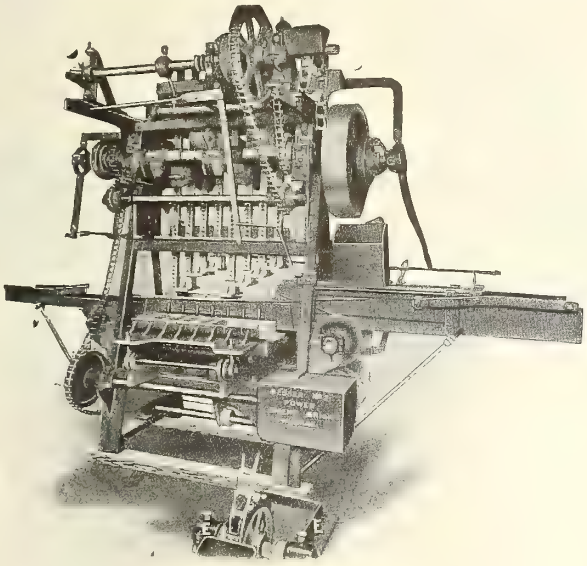
of all types and sizes, Heaters, Tanks, Pumps, etc.

E. Leonard & Sons LONDON ONT.

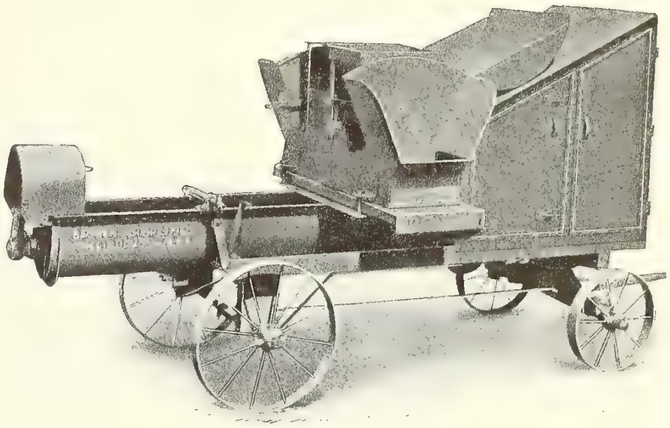
AGENTS:
MONTREAL ST. JOHN, N. B. WINNIPEG CALGARY VANCOUVER

Cement Bricks

Here are the two Besser machines that make the best cement brick on the market. The Brick machine that will make 30,000 bricks per day—every brick the same.



Besser Power Cement Brick Machine



Besser Simplified Continuous Mixer

Woodstock Wind-Motor Co., Ltd.
WOODSTOCK, ONTARIO

Sole Canadian Agents:
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Head Office, 178 Spadina Avenue, TORONTO

Branches:
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316 Lagauchetiere St. W.

Agencies:
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Western Supply & Equipment Company
CALGARY EDMONTON LETHBRIDGE
WINNIPEG Houston & Moore
ST. JOHN, N.B. A. R. Williams Machinery Co
HALIFAX, N. S. " " " "

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Cumberland County Quarries

Red and Grey Freestone

Oakley Myers, Amherst, N.S.

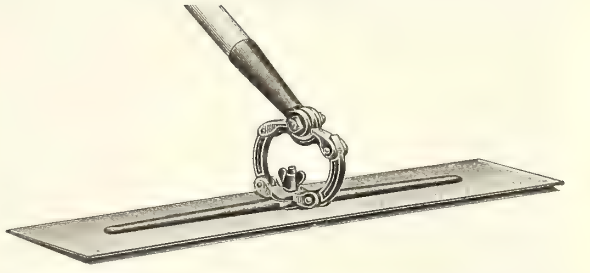
Hardens with Age. Low Price. Samples and Quotations Free

Crushed Stone, Limited

STONE of any Size and in any Quantity on hand for Sidewalks, Roadwork or Concrete Work

Works:
Kirkfield, Ont.
Phone Main 4316

Head Office:
47 Yonge St. Arcade, TORONTO
G. W. ESSERY, Manager



"**Abram**" **Sidewalk Finishing Tools** are sold on the **Guarantee** that **ONE MAN** can do more work with them than **THREE MEN** can do with ordinary tools. This means, if Finishers get $4.00 per day, you save the wages of **TWO MEN**, or $8.00 per day, by using "**Abram**" Tools. We positively guarantee this result. Let us prove it to you. Circular.

ABRAM CEMENT TOOL CO. 105 Ouellette Ave., WINDSOR, ONT.

No Guess Work

About Luxfer Prisms

THE Luxfer system of conveying light by glass prisms is an exact science which is being proved daily in thousands of stores, offices and warehouses in every city in Canada.

Some of the cleverest refractionists of the country are with our organization and their skill and experience is at the disposal of our customers.

If you have a lighting problem—bring it to us and we will show you how it can be solved.

LUXFER PRISM COMPANY, Limited

100 King Street West, TORONTO

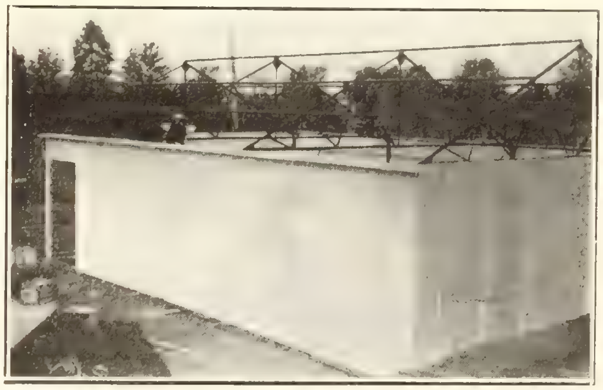
Storage Houses Oil Houses

¶ We have the best possible facility for making all kinds of storage houses of one storey, no matter of what dimensions.

¶ We will undertake to furnish and erect such buildings complete ready for occupancy.

¶ No steel building is too small or too large for us to figure on.

¶ We shall be pleased to furnish estimates and sketches on this class of work at any time. Write us and tell us what you need and we will prepare estimates for you at once.



Cut shows an all-steel building used for storing expensive patterns and dies. The size of this is 18′ x 39′ and it has been doing service for years and gives the same good service as when erected.

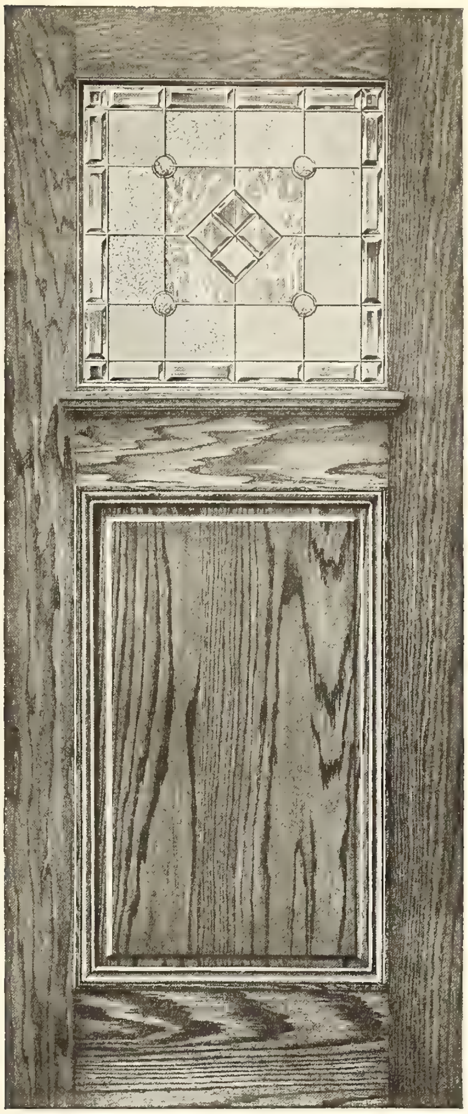
The Metal Shingle & Siding Company, Ltd.

Associated with

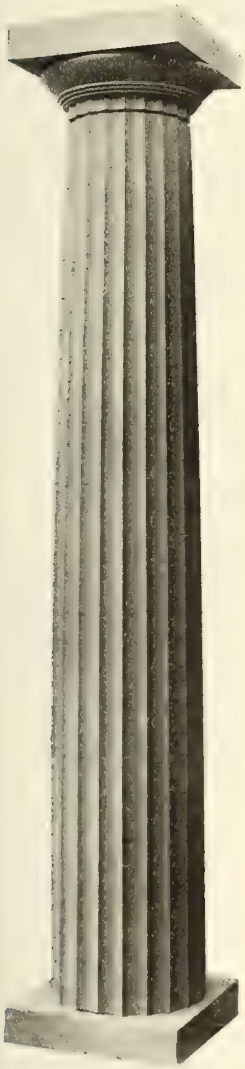
The A. B. Ormsby Company, Limited

Montreal, Toronto, Preston, Winnipeg,
Saskatoon, Edmonton, Calgary.

Doors
Base
Balusters
Columns



Sash
Trim
Turnings
Newels



IF you want high-class doors of good appearance and made of selected woods, we suggest Batts Limited as the place to get them. The workmanship in our doors is thorough and all woods are properly seasoned giving the doors long life.

In our columns the special "V" lock joint makes it impossible for them to crack or open.

Specify "Batts" doors, columns and trim.

Batts
Limited
Pacific Ave., Toronto

NORTHWESTERN ARCHITECTURAL TERRA-COTTA

Canadian Agents

Black Building Supply Co., Ltd., TORONTO
Reynolds-Wardell. Ltd., MONTREAL
W. T. Grose Co., WINNIPEG
J. B. Royle Supply Co., Ltd., CALGARY, ALTA.
Smiley Company, EDMONTON, ALTA.
Whitlock-Ridell Co., MOOSE JAW SASK.
Robert Sclanders, SASKATOON SASK.
Brown, Herod & Chapman, REGINA, SASK.
J. B. Turney & Co., LETHBRIDGE ALTA.
Carter-Dewar Crowe Co., Ltd., VANCOUVER B.C.

Can. Pac. Rly. Building, Toronto, Can.
The Tallest Building in British Empire.

Architectural Terra-Cotta manufactured and supplied by

NORTHWESTERN TERRA-COTTA CO.
2525 CLYBOURN AVE.
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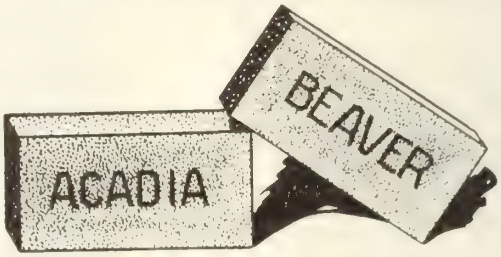

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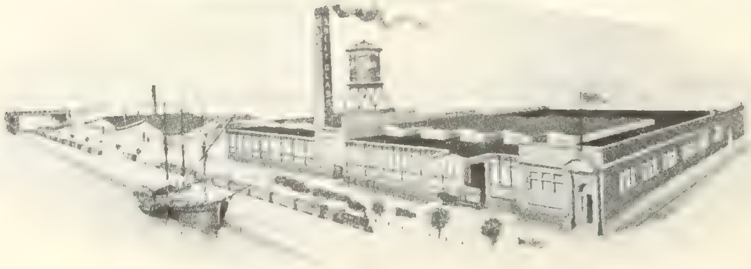

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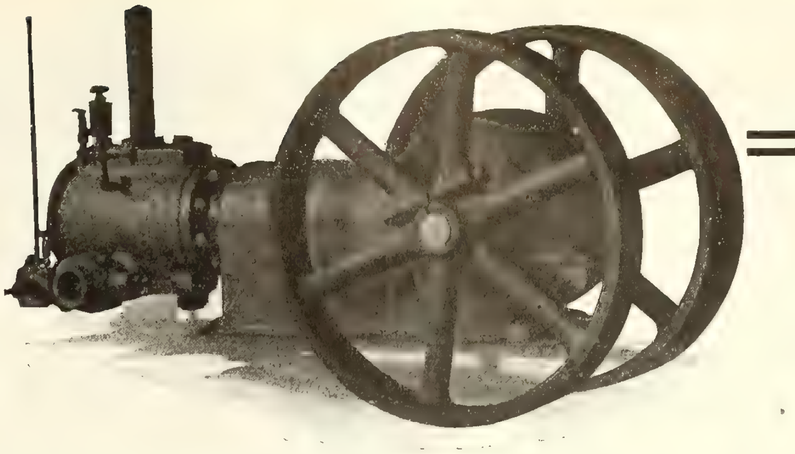

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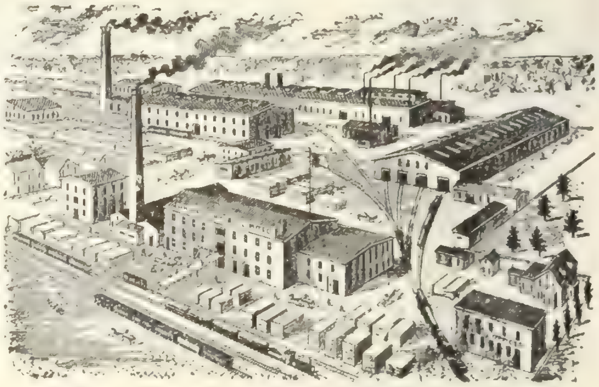

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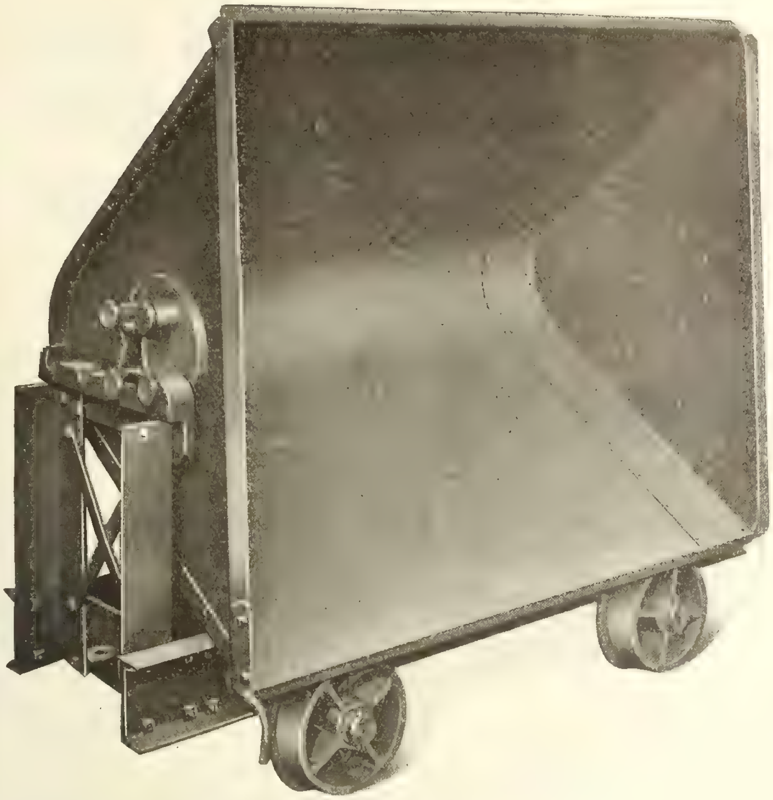

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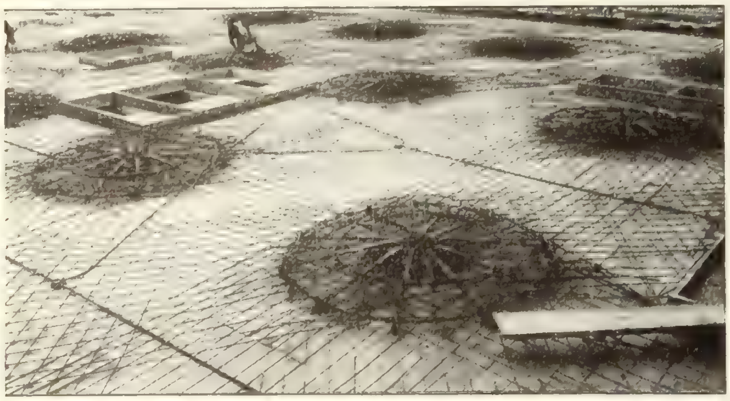

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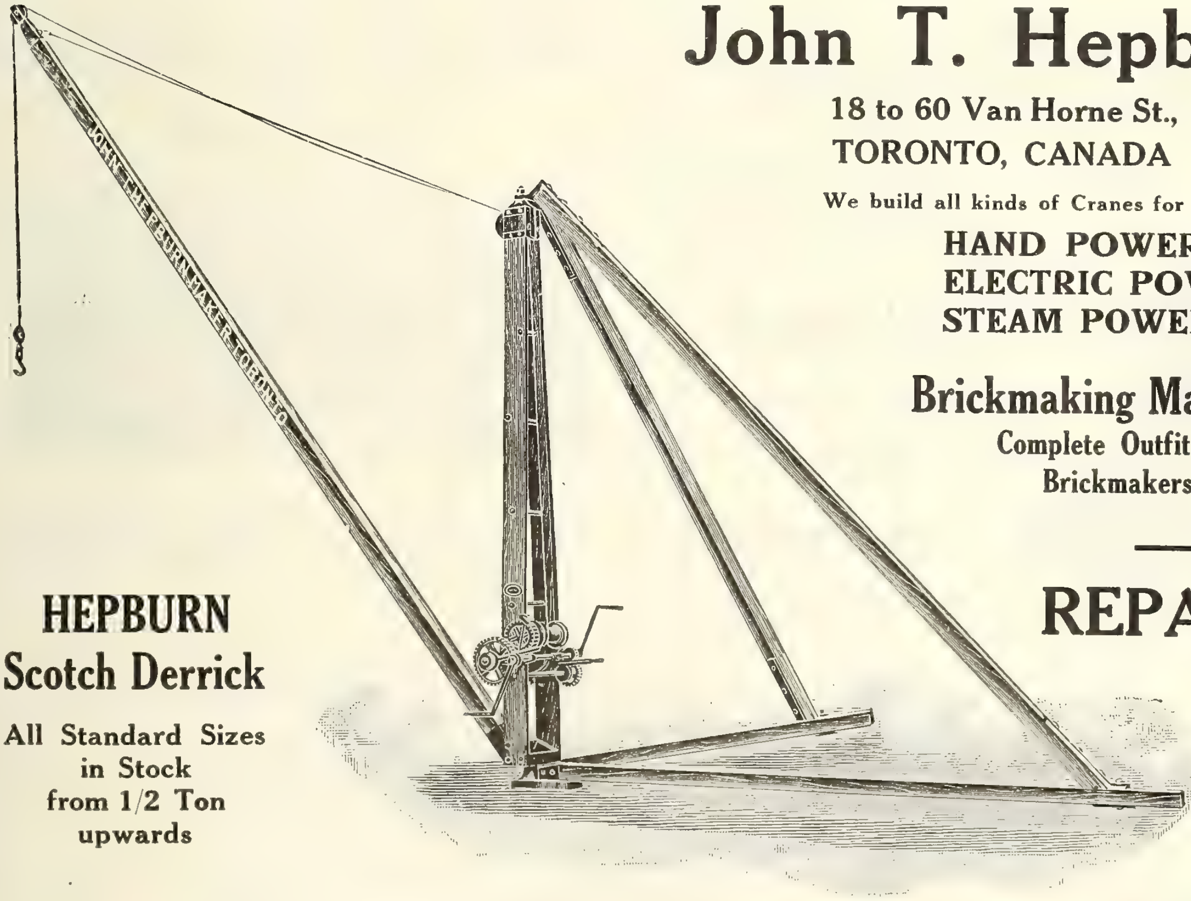
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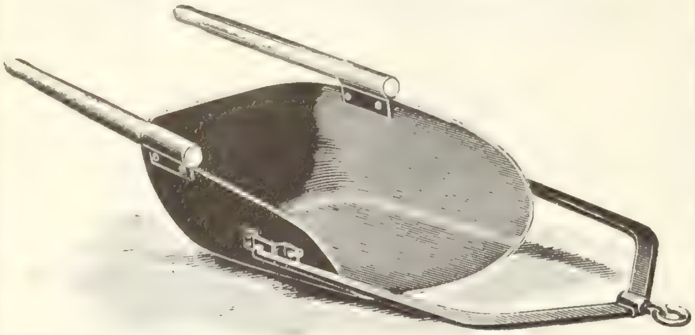

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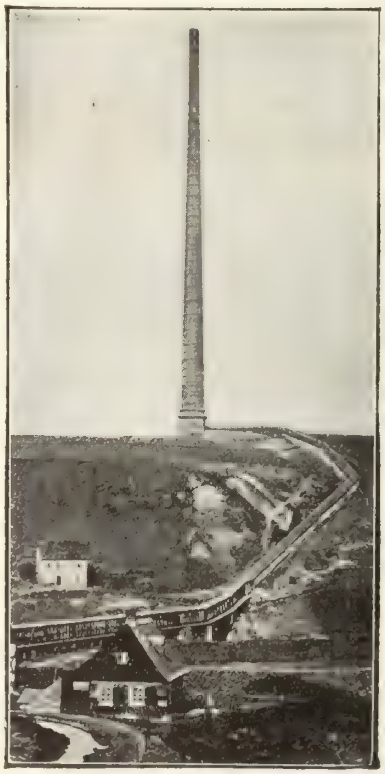

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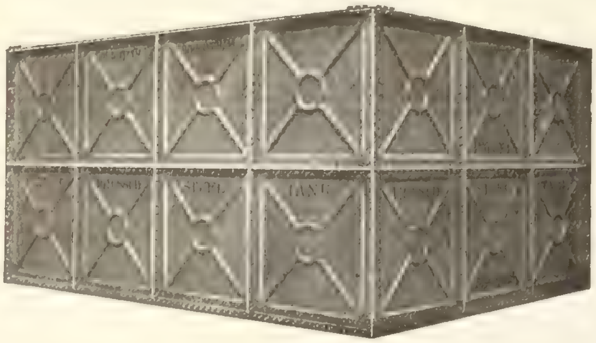

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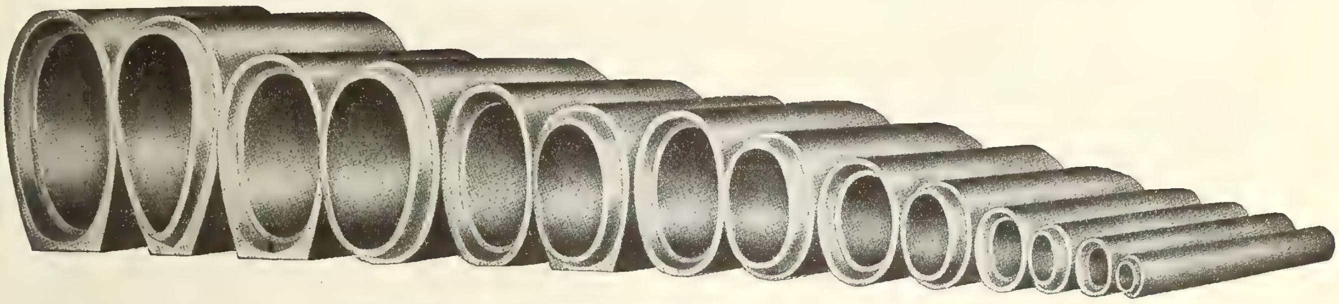

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OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

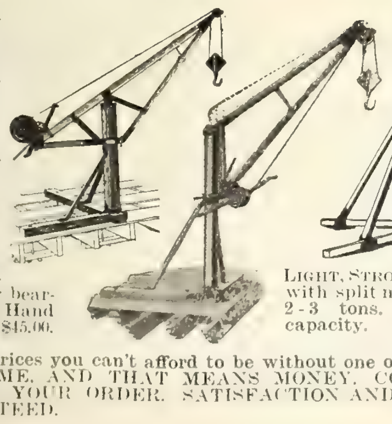
Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application.

Dominion Concrete Company Ltd.

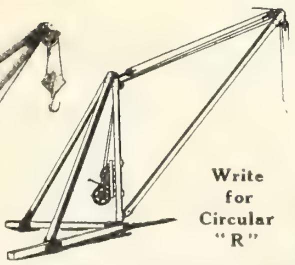
Kemptville, Ontario

The Most COMPLETE LINE OF BUILDERS' DERRICKS MADE



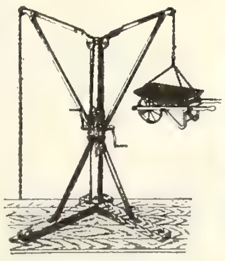
Reinforced Standard 2500 lbs. capacity with geared winch complete $48.00 or for Hand and Power $51.00.

Peerless Steel Derrick full circle swing, self-lubricating bearings, $43.00 Hand and Power $45.00.

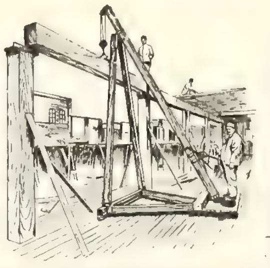


Light, Strong, Stiff Leg Derrick with split mast and boom, capacity 2-3 tons. Price according to capacity.

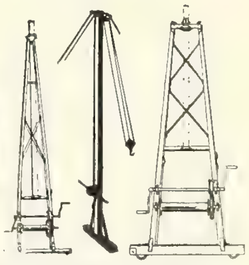
Write for Circular "R"



Double Boom Wheelbarrow Derrick full circle swing. Sufficient chain for 3 story building. Price $68.



"A" Frame Builders Derrick 1800 lbs. capacity $48.00; 2500 lbs. capacity $51.00.



T. P. SETTER DERRICK. POLE DERRICK. REGULAR SETTER DERRICK.

At these prices you can't afford to be without one of these derricks. THEY SAVE TIME, AND THAT MEANS MONEY. CONSULT US BEFORE PLACING YOUR ORDER. SATISFACTION AND PROMPT SHIPMENT GUARANTEED.

Don't Hire Men to Carry Up Your Material, Hoist It with a SASGEN DERRICK.

SASGEN DERRICK CO.,

13 Jarvis St.
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CHICAGO OFFICE:
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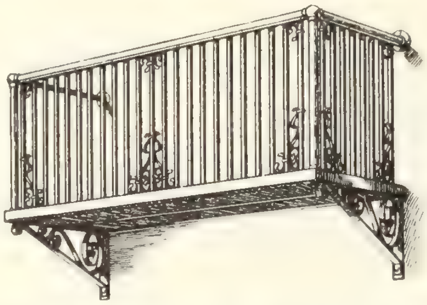
INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

ALL OUR DOORS AND HARDWARE ARE LABELLED BY THE UNDERWRITERS.

FEATHER & ROADHOUSE SHEET METAL WORKERS
Phone Adelaide 2377 528 FRONT STREET WEST, TORONTO



Wrought Iron Balconies

Porch Railings Stair Railings

Fire Escapes

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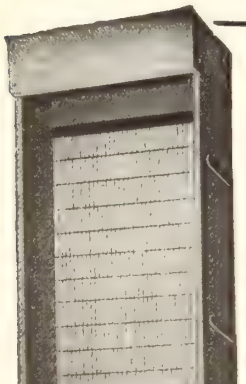
Send for Catalogues

Dennis Wire & Iron Works Co.
London, Ont. Limited

Toronto Branch : 36 LOMBARD STREET

Dominion Marble Company
Limited
Montreal, Que.

SOLE producers of the Beautiful Royal Dominion marble quarried at South Stukely, Que. A card or 'phone call will bring our representative to submit figures on any class of marble work. Address all letters to the Company P.O. Box 1166, Montreal.



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SAND and GRAVEL SCREENS

We make SCREENS for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
Hamilton

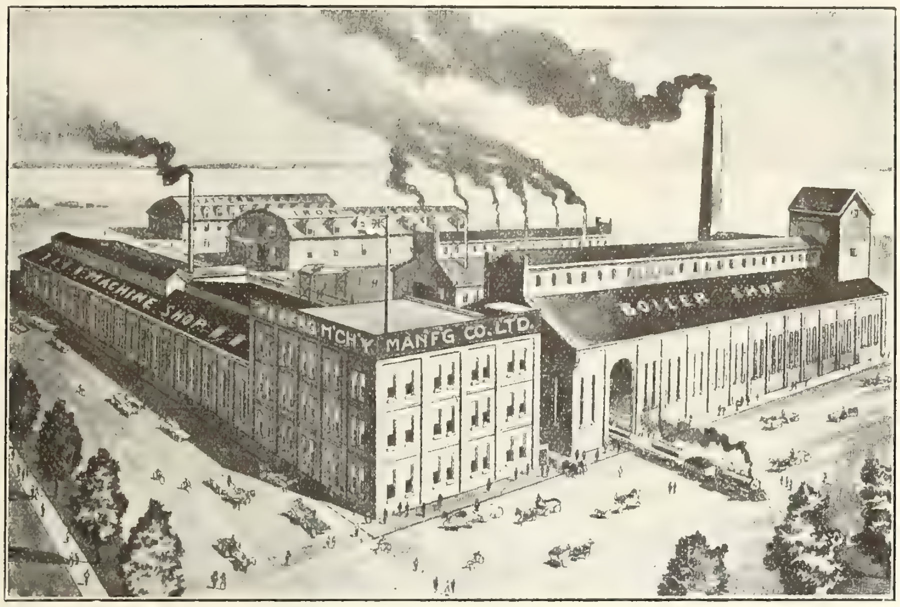
Pioneer Manufacturer of

Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.
The benefit of 20 years experience as successful contractors.

Yours for the Asking

Hotchkiss Lock Metal Form Co.
BINGHAMPTON, N.Y.



The Berg Plant at Toronto

Berg Boilers

Our prices are right and our shipments prompt for every kind of boiler and plate work : : : : : : : :

Water Tubes

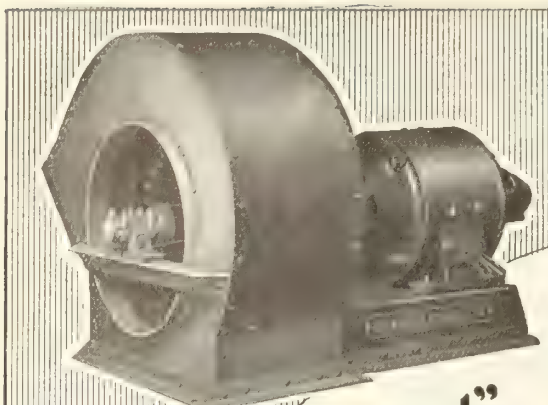
Horizontal Return Tubular
Fitzgibbons, Scotch Marines, Scotch Drybacks

Steel Water Towers, Tanks and Heavy Plate Work.
Cast Iron Columns and Bases. Post Hangers

The Berg Machinery Mfg. Co., Limited

Boiler Department

Bathurst and Niagara Sts. **TORONTO, ONTARIO**



"Buffalo" Fans

For Heating, Ventilating, Drying and Exhausting.

Ask our engineers to recommend the fan best suited to your requirements. Our designs include the new high-efficiency "*Conoidal*" multiblade fan, used extensively for heating systems, mine and tunnel ventilation, and the motor-driven *Steel Plate Pressure Blower*, giving pressures up to 24 oz. Both of these designs show higher efficiency than obtained with any similar types. We specialize in *direct-connected* units (motor, engine or turbine driven) for every service. These are distinguished by absence of belt troubles and the very lowest power consumption. Whatever your problem write us.

CANADIAN BUFFALO FORGE CO., Limited

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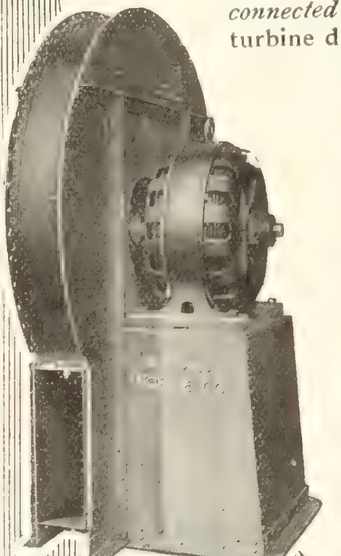
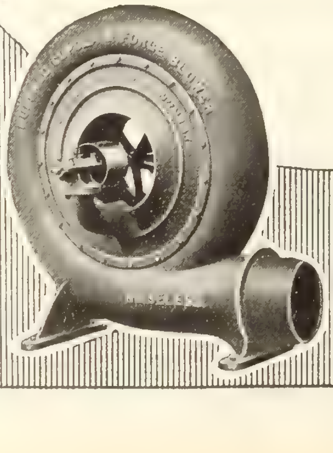
St. John Toronto
Winnipeg Vancouver





Marshall-Wells Building, Winnipeg

Another TUEC Cleaned Building

TUEC Stationary Air-Cleaning System

Canadian Factory—
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Jas. J. Martindale.

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The ribs on the bottom prevent slipping when used at an angle

POWER

Combined with Easy Operation

This is accomplished by a single arrangement of gears, which so compounds the leverage in Barrett Geared Jacks, that heavy loads up to 40 tons are raised as easily as the ordinary type of jack raises a light load.

BARRETT Automatic Geared JACKS

are designed for the rapid and convenient handling of freight cars, Passenger or Pullman Coaches, Locomotives, etc. They are made in capacities of 20 to 40 tons and a variety of heights. Simplicity of design and construction, and the absence of any complicated features insures freedom from maintenance and repair charges.

Our catalog No. 15 illustrates many sizes and styles of jacks—Write for a copy today

The Canadian Fairbanks-Morse Co., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary
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4

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Fourth of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

Electric Railway Chambers Winnipeg

This building was wired with
"Imperial Higrade" Rubber Insulated Wire

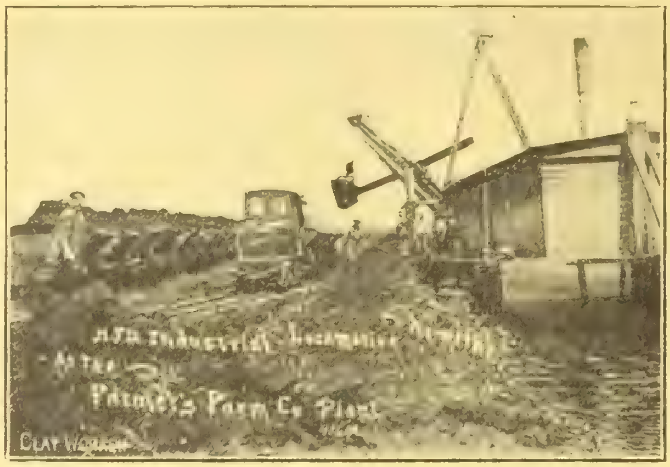
Architect; Pratt & Ross, Winnipeg.
Engineers; Neiler, Rich Co., Chicago.
Electrical Contractors; Schumacher Gray Co., Winnipeg.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd. Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"



Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

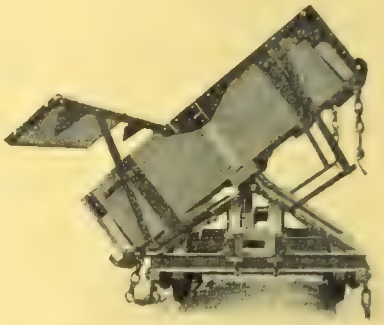
Suitable For

Brickyards, Quarries, Mines, Contractors, etc.

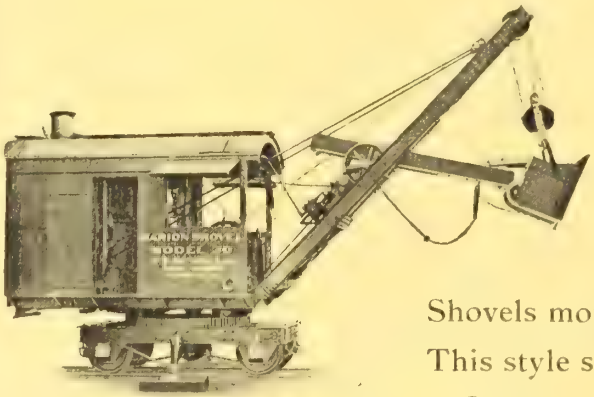
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars



We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



"MARION"

STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
58 - 1 and 1 12 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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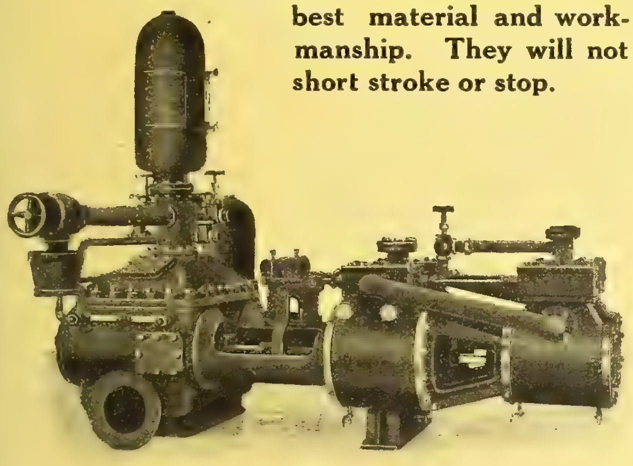
Vol. 27 Toronto, October 15, 1913 No. 42

Contract Record and Engineering Review

ESTABLISHED 1886



We manufacture all kinds of Steam and Power Pumps for all kinds of services, using only the best material and workmanship. They will not short stroke or stop.

THE SMART-TURNER MACHINE CO. LTD.
HAMILTON, CANADA

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
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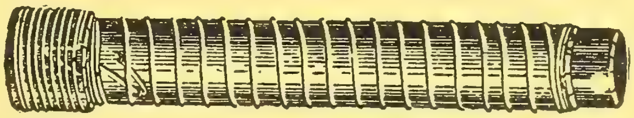
INGERSOLL-RAND
SHEET PILE DRIVERS
FOR WOOD OR STEEL
SHEET PILES

This machine is comparatively light but does the work of a much heavier type owing to the careful distribution of the weight involved.

Canadian
Ingersoll-Rand
Co., Limited
MONTREAL, CAN.



Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16

Classified Directory to Advertisements, Page 6

Complete and Self - Contained Rock Crushing Plants

The cut shows an outfit that can "follow the job,"—one that crushes, grades and loads. We build them in many sizes and combinations.

The Jenckes Machine Co., Limited

Sherbrooke, Montreal, Toronto, St. Catharines,
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CROWD IT

RUSH IT—JAM IT

UP WITH WORK—THERE'S NO DANGER OF THE

"AMERICAN" Hoisting Engine

"LAYING DOWN"

IT STANDS FIRM UNDER THE HARDEST DUTY
IT PULLS TO THE LIMIT
IT'S THE ENGINE WITH THE PERFECT FRICTION

If you need EXPERT ADVICE regarding Hoisting Engines, write us

American Hoist & Derrick Co.

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"AMERICAN" DERRICK ENGINE

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SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
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CANADA
CEMENT
MONTREAL

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

Canada Cement Company, Limited

Head Office - Montreal

Sales offices at

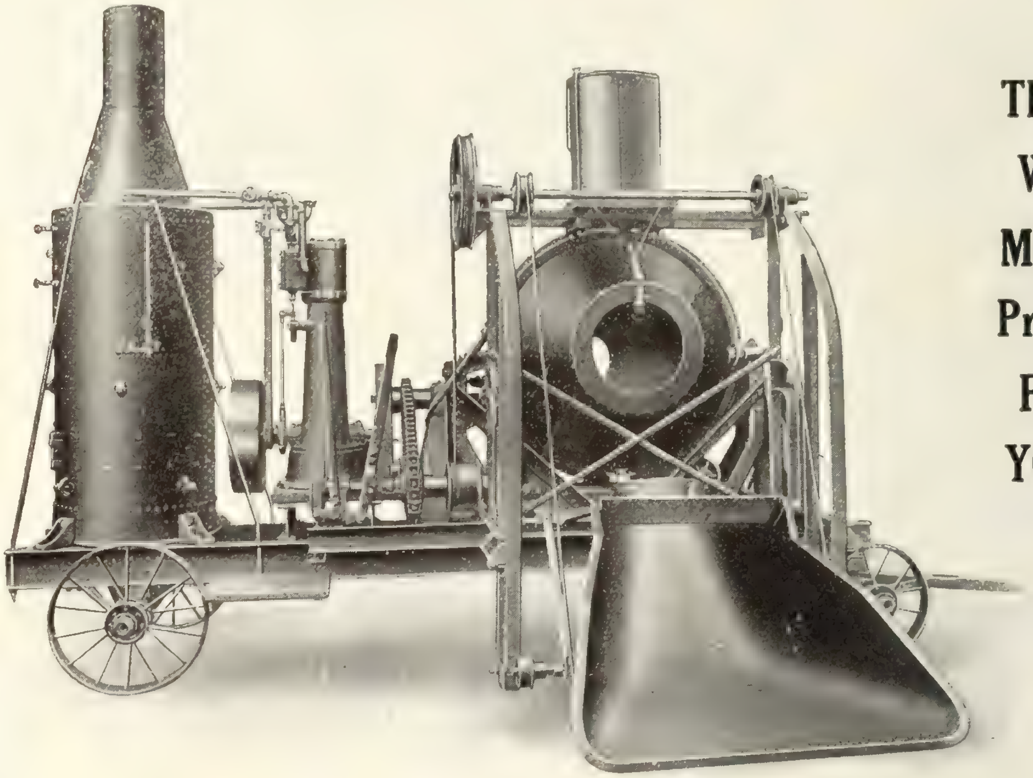
Montreal - Toronto - Calgary - Winnipeg

You See Them On The Big Jobs

Because it is necessary to have mixers that will not break down where large gangs are employed.

They Have Made Profits For Others

They Will Make Profits For YOU



SMITH MIXERS

NEVER FAIL

Send for Catalogue.

Mussens Limited

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COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 365 Water Street

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ST. JOHN, N.B., 57 Smythe St.
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TRUTH

Is Recognized.

EVERY CLAIM

We Have Ever Made for the

Smith Concrete Mixer

has been backed up by the machine.

Every person who has a SMITH knows that he has a machine that will save him money because it is built right, it works right and it lasts.

Carried in Stock.

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TORONTO, 155 West Richmond St.
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WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
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QUEBEC, 71 Maple Ave.
ST. JOHN, N.B., 57 Smythe St.
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Can. Ingersoll-Rand Co., Ltd.

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Weeks, Arthur L.

Architects' Instruments
Stanley Co., W. F.
W. & L. E. Gurley.

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Canada Wire & Iron Goods Co.
Dennis Wire & Iron Works.
Dom. Ornamental Iron Works.
Eberhard & Wood
McGregor & McIntyre
Meadows Co., Geo. B.
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Feather & Roadhouse.
Ormsby Co., Limited, A. B.
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Metallic Roofing Co.

Architectural Terra Cotta
Black Building Supply Co., Ltd.
Don Valley Brick Works.
Gibbs & Canning.
Northwestern Terra-Cotta Co.
Toronto Plate Glass Imp't'g Co.

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Baker, John Jr.
Barber Asphalt Paving Co.

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Goodyear Tire & Rubber Co.
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Dominion Belting Co.

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Can. Ingersoll-Rand Co., Ltd.
Canadian Sirocco Co.
Douglas Milligan Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.

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Boving Company of Canada.
Inglis Company, John.
Jenckes Machine Co.
Leonard & Sons, E.
Marsh & Henthorn.
McDougall Caledonian Iron Wks.
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Waterous Engine Works Co.
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Chipman & Power
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Galt Engineering Co., John
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Thorold Co., F. W.

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Star Expansion Bolt Co.

Expanded Metal
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Exhaust Heads
Canadian Buffalo Forge Co.
Sheldons Limited
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Gurley, W. & L. E.

Filters
American Water Softener Co.

Fire Brick
Improved Equipment Co.
Ontario Lime Co., Ltd.
Smyth & Ryan.

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Mussens Limited
Ormsby Co., Limited, A. B.
Steel & Radiation Ltd.

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Consumers Gas Co.

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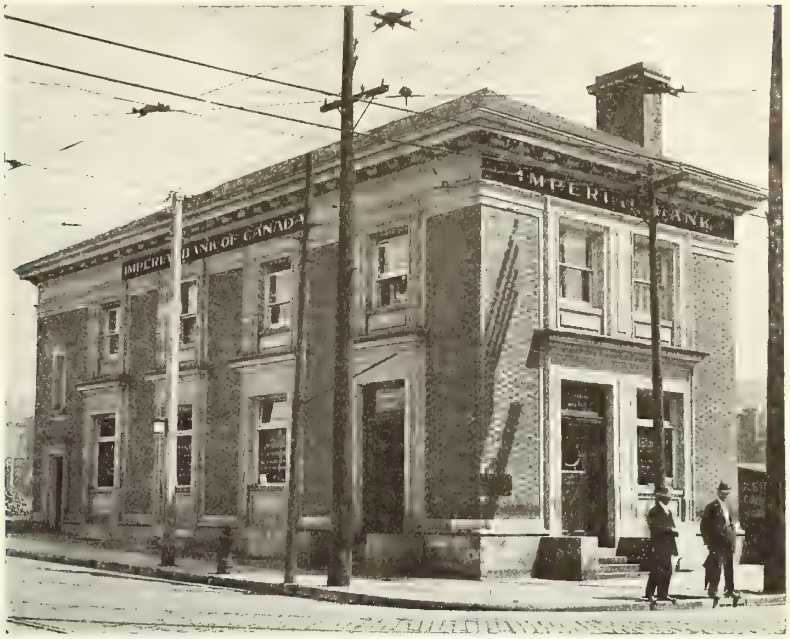
Kerr Engine Company

(Continued on page 12)

DON VALLEY



Imperial Bank, Roncesvalles Ave. and Queen St., Toronto

THE Don Valley Buff Oriental Bricks are particularly well suited for bank and public buildings. They are burned to give a variety of flashes which lend a soft and pleasing effect to any building.

For Toronto's General Hospital over twenty million of these brick were used.

The decorative possibilities of Don Valley Bricks are without number and that they add distinction and attractiveness to a building is acknowledged.

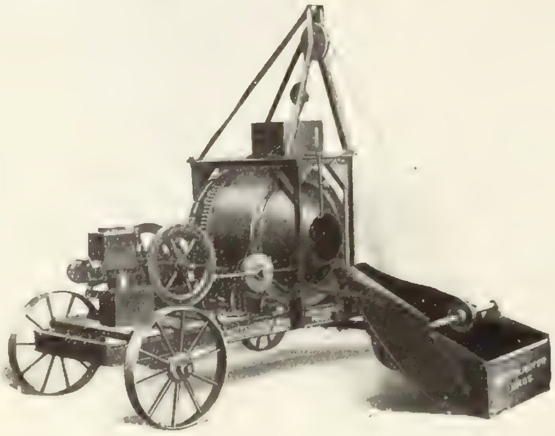
Specify Don Valley Bricks

Don Valley Brick Works

Toronto, Ont.

Wettlaufer Bro's
IMPROVED CONCRETE & ROAD MACHINERY

MIXERS
HOISTS
TILE MACHINES
BRICK MACHINES
CRUSHERS
PUMPS



Buy a Wettlaufer

And join the ranks of our satisfied customers—engineers, contractors, paving companies, brick manufacturers and the various companies in whose line of business mixers are an essential factor.

Our new Stationary Heart Shape Drum Mixer surpasses all our former efforts, and we emphatically assert that from every point of view it is as perfect a mixer as is possible to produce.

The combination of the Heartshape Drum, which in itself is a thorough mixer, and the mixing blades makes the Wettlaufer the fastest mixer on the market.

We invite you to attend a daily demonstration at any of our branches

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.
Factories: Mitchell, Ont., Buffalo, N.Y., Detroit, Mich.

AGENCIES:
A. E. Hodgert, Regina, Sask. Maysmith & Lowe, 1057 Mears St., Victoria, B. C. A. R. Williams Machinery Co., 15 Dock St., St. John, N.B. The Canadian-British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man. R. F. Mancill, 117 10th Ave. East, Calgary. The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C. J. L. Lachance, Ltd., 363 St. Paul St., Quebec. Wettlaufer Bros., 316 Lagauchetiere St. West, Montreal, Que.

THE FAMOUS WETTLAUFER HEARTSHAPE MIXERS

Rogers' Portland Cement

AND CRUSHED STONE

The most dependable for all types of construction and engineering-contracting work — especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, &c.

Rogers' Brands:

PYRAMID DORIC SUPERIOR
STERLING SAUGEEN

Mills at:

KIRKFIELD ST. MARY'S HANOVER
ORANGEVILLE OWEN SOUND

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

Concrete Tank at Berlin, Ont.
BUILT WITH ROGERS' CEMENT.
L. J. MENSCH, M. Am. Soc. C.E., CHICAGO, ILL.
Engineer and General Contractor.

Crushed Stone

Our crushed stone is free from dust, dirt and mold—it is really clean stone—properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

Quarries at Dundas and Vinemount

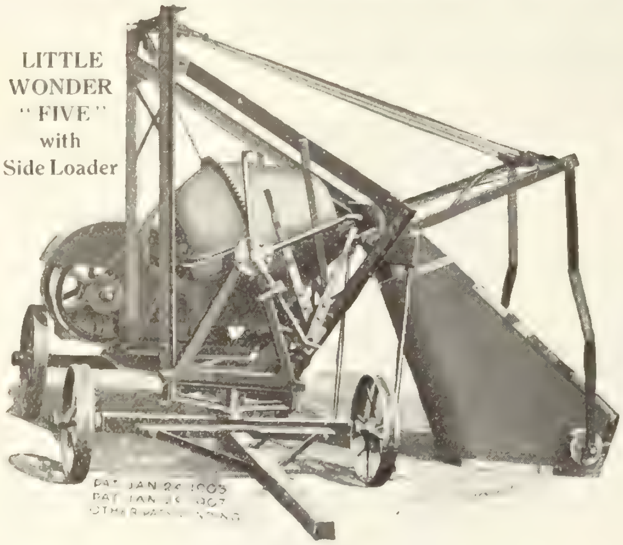
Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

Wonderful Things

LITTLE WONDER "FIVE" with Side Loader



are told about the

WONDER

line of Concrete Mixers and the WONDER is they're true. Nobody thinks now-a-days of buying a mixer without first investigating the

LITTLE WONDER "FIVE"

and

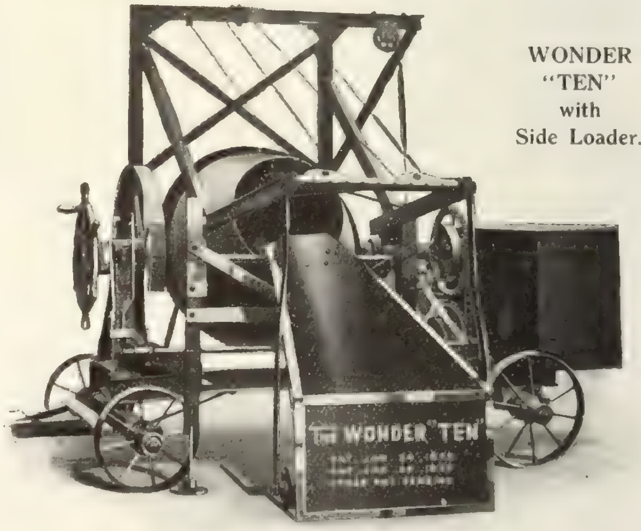
The WONDER "TEN"

These mixers place concrete work on a new basis. They make double the money and save time and labor over old methods. They are enthusiastically endorsed by thousands of contractors.

ABSOLUTELY FREE TRIAL

on your own work is our offer to you. Get the details.

WONDER "TEN" with Side Loader.



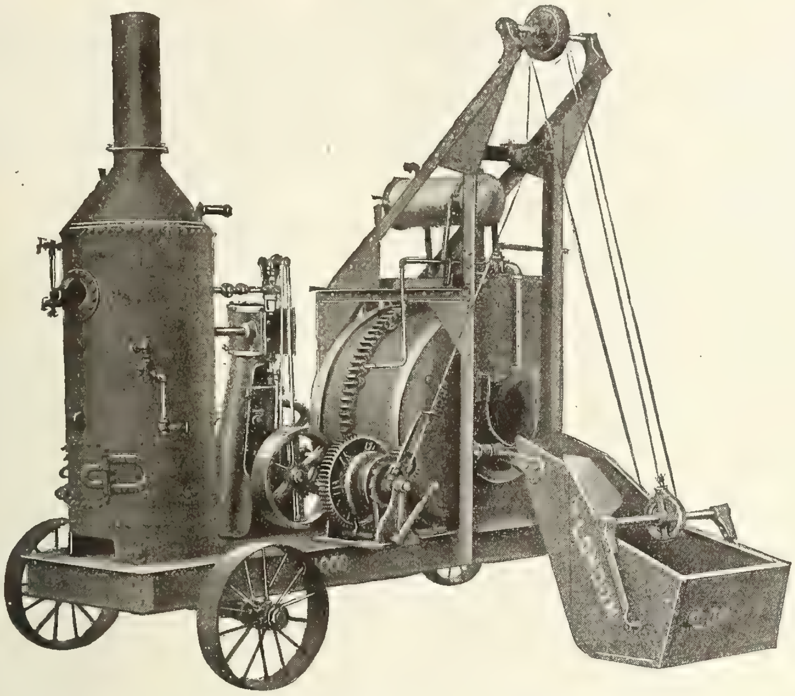
WATERLOO CEMENT MACH'Y CORP'N

117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists, Elevators and Cement Tools

CANADIAN REPRESENTATIVES:—Waterloo Cement Mach'y Corp'n, 127 Coristine Building, Montreal, Que.; General Mach'y Co., 22 Mulock Ave., Toronto, Ont.; J. W. Anderson, 3 Bank St. Chambers, Ottawa, Ont.; J. A. McTaggart & Co., Winnipeg, Man.; Strumbert, Virtue & Co., 319 Pender St., Vancouver, B.C.

CONCRETE MIXERS



London Standard Drum Batch Mixer

Several Kinds, and built in sizes to suit all classes of work

The many improved features of the London Mixers have placed them in a class by themselves.

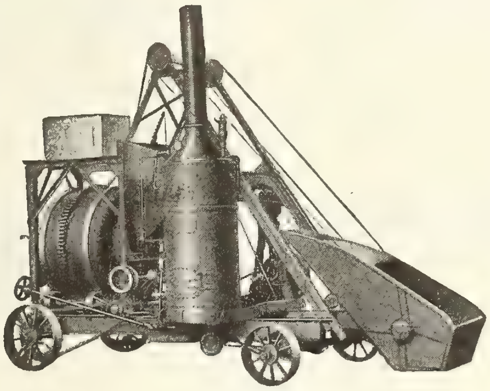
We can save the contractors money—

On First Cost
On Cost of Maintenance
On Cost of Operation

SEND FOR OUR CATALOGUE

We manufacture a full line of Concrete Machinery and Cement Working Tools.

Also a full line of Hoisting Engines and Contractors' Equipment.

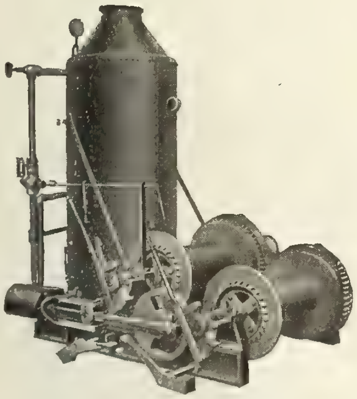


Rear Discharge Paving Machine with Forward Loader

Every machine made in our own factory.

Our machines are not made down to a price, but **made up to a standard.**

By manufacturing on a **large scale** we have been able to offer **high grade machines** at **remarkably low prices**



Standard Hoisting Engine

We are the Largest Manufacturers of Concrete Machinery in Canada

No. 2 Automatic Batch Mixer

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:
WINNIPEG (445 Main St.) W. H. Rosevear, Mgr. CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (60 Richmond St. E.) F. D. Emsley, Mgr.

AGENCIES:
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FORT WILLIAM, Northern Eng. & Supply Co. MONTREAL, Foss & Hill Mach. Co. QUEBEC, A. D. Masson

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Insulating Compounds
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Canadian Allis-Chalmers, Ltd.
Waterous Engine Works

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Boving Company of Canada.
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Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
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Linde British Refrigeration Co

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Steel Company of Canada
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
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Revolving Stone Screens
Greening Wire Co., B.

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Barber Asphalt Paving Co.
Asphalt & Supply Co.

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Erie Machine Shops
Lecky & Collis
Morrison & Co., T. A.
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Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.

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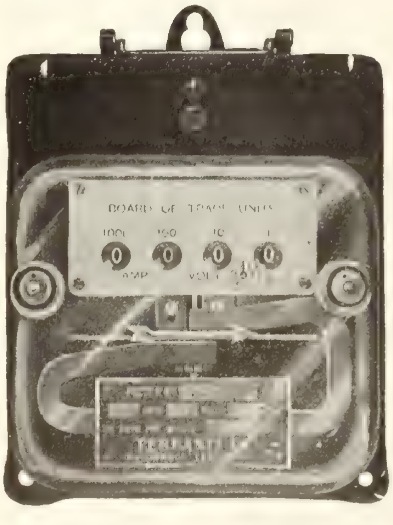
Ferranti Meters



Glass Case—Top Connections

Simplicity of construction.

Perfect accuracy.

Cyclometer or clock dials.

Top or bottom connections.

Prompt deliveries.

Every meter carefully inspected before shipment.

Absolutely guaranteed.

Send us your probable meter requirements and let us make you a proposition.

Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

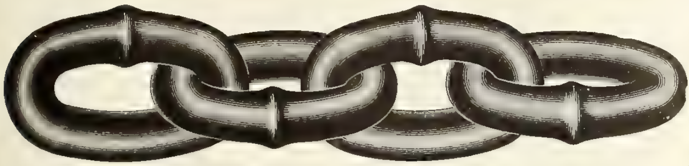
Steel Case—Top or Bottom Connections

The Ferranti Electrical Co., of Canada, Limited

TORONTO
90 Sherbourne St.

WINNIPEG
56 Albert St.

Electric-Welded Chain



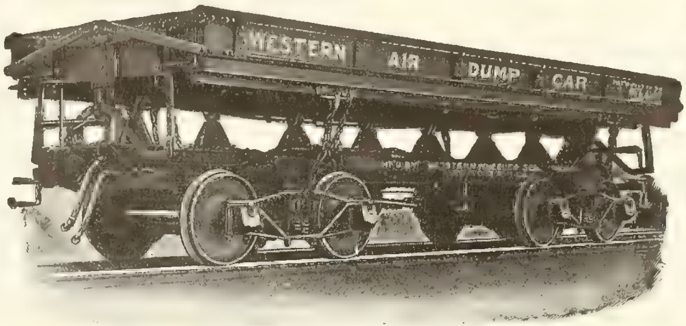
Two New Sizes

Size in inches	⅝	¾
Links per foot	6	5⅓
Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
Breaking Test	26,000 lbs.	36,000 lbs.
Working Load	8,000 lbs.	11,000 lbs.

Made in Canada × **25% Stronger** × **Sold by Jobbers**

McKinnon Chain Company
St. Catharines, Ont.

A Prominent Railroad Company Proved a Saving of 50% With



The Western Air Dump Car

These cars have great load capacity, speed of running and instantaneous and certain dumping action. They save their price in a short time by their saving of hand shoveling costs alone. Made in 12, 16, 20 and 30-yard sizes (40,000, 60,000, 80,000, and 100,000 lbs. capacities).

Used by Canadian Pacific and many other railroads and by Canadian contractors generally. Quick deliveries.

Western Wheeled Scraper Co.
Earth and Stone Handling Machinery
Aurora, Illinois

Hagersville Crushed Stone

The Toughest Stone for Macadam in Ontario

Record of Logan Avenue, Toronto, Macadamized from Queen St. to Gerrard St., in 1902

Length 2,454 Lin. Ft. Width 24 Lin. Ft. 6,550 Sq. Yds.

COST FOR REPAIRS

1903	$ 0.00	1908	$ 93.26
1904	3.30	1909	200.46
1905	9.35	1910	14.07
1906	37.33	1911	2.29
1907	16.11		

Total $376.17 or 5⅔c. per sq. yd. for repairs for nine years, a little over 6-10 of 1c. per sq. yd. per year.

Why Not Use Hagersville Stone and Get These Results?

Hagersville Contracting Co.

Hagersville, Ont. **Limited**

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- Canadian Fairbanks-Morse Co.

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- Sand and Supplies Limited
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- Alfred Rogers Limited

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- Stand. Plow Company

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- Greening Wire Mfg. Co., B.
- Weller Mfg. Co.

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- Canadian Mineral Rubber Co.

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- Britnell & Company
- Canada Iron Corporation
- Dominion Sewer Pipe Co.
- Gartshore Thomson Pipe Co.
- National Iron Works
- Ontario Lime Co., Ltd.
- Ontario Sewer Pipe Co.
- Smyth & Ryan
- Standard Clay Products Ltd.
- Nova Scotia Clay Works Ltd.

Sewer Trenching
- Lecky & Collis

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- Cabot Inc., Samuel

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- Browning Engineering Co.
- Beatty & Sons, M.
- Canadian Allis-Chalmers, Ltd.
- Hopkins & Co., F. H.
- Montreal Locomotive Works
- Mussens Limited
- Thew Automatic Shovel Co.

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- Chicago Bridge & Iron Works
- Des Moines Bridge Co.
- Hamilton Mfg. Co., Wm.
- Walsh Plate & Structural Works

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- Lundy Shovel & Tool Co.

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- Cabot, Inc., Samuel
- Pinchin, Johnson & Co.

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- McGregor & McIntyre

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- Canadian Buffalo Forge Co.
- Pittsburgh Valve, Foundry & Construction Company
- Sheldons Limited
- Sturtevant Co. of Can. Ltd. B. F.

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- Mannesmann Tube Co.

Steam Turbines
- Canadian Allis-Chalmers, Ltd.
- McDougall Caledonian Iron Wks.

Steel
- Canada Steel Co., Ltd.
- Dominion Steel Castings Co.
- Lecky & Collis

Steel Bars
- Canada Steel Co., Ltd.
- Steel Co. of Canada
- Steel & Radiation, Ltd.

Stone
- Britnell & Company
- Brodie, James
- Consolidated Stone Company
- Contractors' Supply Company
- Crushed Stone, Limited
- Hagersville Contracting Co.
- Mahan & Company
- McMillan & Son, W.
- Morrison & Co., T. A.
- Myers Oakley
- Ontario Lime Co., Ltd.
- Queenstown Quarry Co.
- Rogers Supply Company
- Sackville Freestone Company
- Sand & Supplies
- Smyth & Ryan

Stone Saws
- Anderson, Geo.

Store Fronts
- Zouri Drawn Metals Co.

Structural Iron and Steel
- Canadian Allis-Chalmers, Ltd.
- Canada Steel Company
- Chicago Bridge & Iron Works
- DesMoines Bridge Company
- Dominion Bridge Company
- Dominion Steel Castings Co.
- Hamilton Bridge Works Co.
- Mackinnon Holmes & Co.
- Maritime Bridge Company
- McGregor & McIntyre
- Phoenix Bridge & Iron Works
- Reid & Brown
- Sarnia Bridge Company
- Steel Company of Canada
- Structural Steel Company
- Standard Steel Construction Co.
- Walsh Plate & Structural Wks.

Submarine Drills
- Lecky & Collis

Swinging Gears
- Dake Engine Company

Tanks and Stand Pipes
- Chicago Bridge & Iron Works
- DesMoines Bridge Company
- Hamilton Mfg. Co., Wm.
- Inglis, John
- Jenckes Machine Co.
- Marsh & Henthorn
- McDougall Caledonian Iron Wks.
- Ontario Wind Eng. & Pump Co.
- Piggott & Co., Thos.
- Walsh Plate and Structural Wks.
- Waterous Engine Works Co.

Testing and Inspecting Bureau
- Hunt & Co., Robt. W.

Underground Conduit
- Dietrich Limited

Ventilating & Heating Apparatus
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.
- Canadian Sirocco Company

Vacuum Cleaners
- Tuec Company
- Canadian Allis-Chalmers, Ltd.
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company
- Pittsburgh Valve, Foundry & Construction Company

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- Standard Underground Cable Co. of Canada, Ltd.

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- Can. H. W. Johns-Manville Co.
- Can. Supply & Contracting Co.
- Ceresit Waterproofing Co.
- Pinchin, Johnson & Company
- Wadsworth Howland Co.

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- American Water Softener Co.

Water Tapping Machine
- Mueller Mfg. Co., H.

Water Turbines
- Canadian Allis-Chalmers, Ltd.
- Boving Company of Canada
- Escher Wyss & Co.
- Hamilton Mfg. Co., Wm.
- McDougall Caledonian Iron Wks.

Wires and Cables
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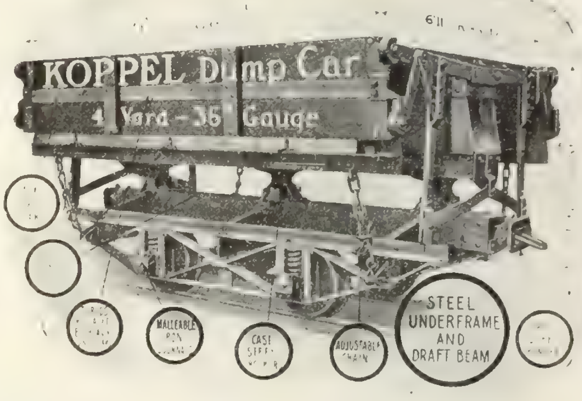
- Imperial Wire & Cable Co.
- Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
- Canada Wire & Iron Goods Co.
- Greening Wire Co., B.
- Steel Company of Canada

Wire Rope
- Canada Wire & Cable Co.
- Greening Wire Co., B.
- Steel Company of Canada

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein - Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Tarvia

Preserves Roads
Prevents Dust~

Section of Governmen Parkway, Ottawa, Canada, treated with "Tarvia B."

Dust is Expensive

When an automobile speeds down an ordinary macadam road it leaves in its wake a cloud of dust which is carried by the winds over the neighboring fields, houses and lawns.

This is just as surely a waste of good material as if the automobilist dug material out of the highway and carted it away. Dust represents waste—costly waste—and the taxpayers feel the result. A road that is properly built for modern traffic will not be dusty.

Plain macadam gives way under the wear and tear of heavy rubber-tired automobile wheels and the surface binder of the road is torn away in the form of dust, until in time the coarse stone itself is exposed and a costly renewal of the road is necessary.

Modern roads should be built to resist modern traffic. To build any other kind is wasteful. A better binder than the ordinary mineral binder is needed and is offered in Tarvia, a coal tar compound especially prepared for use on roads.

Tarvia is dense, viscid, waterproof. It fills the interstices between the stone and forms a tough, plastic matrix. This makes a waterproof and automobile-proof surface. The maintenance cost is usually so low as to more than balance the cost of Tarvia treatment. Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.

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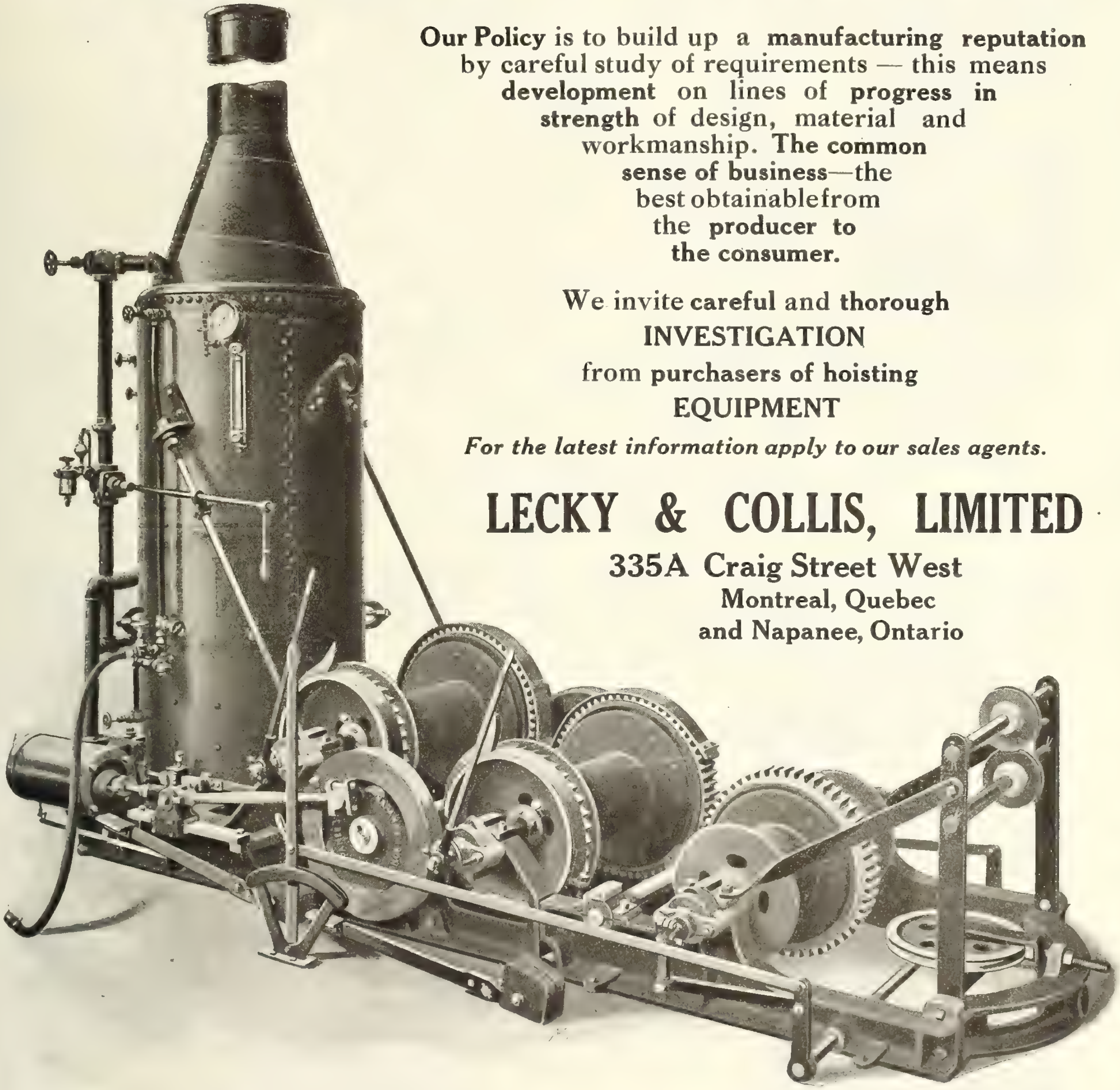

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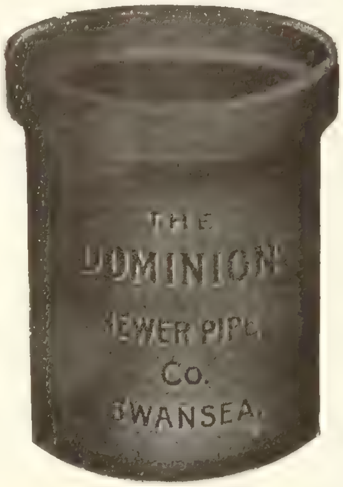

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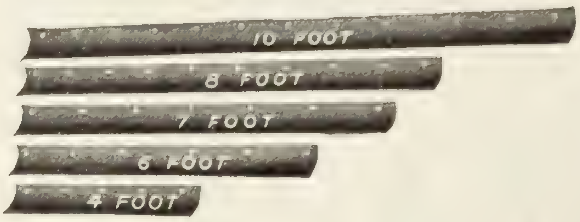

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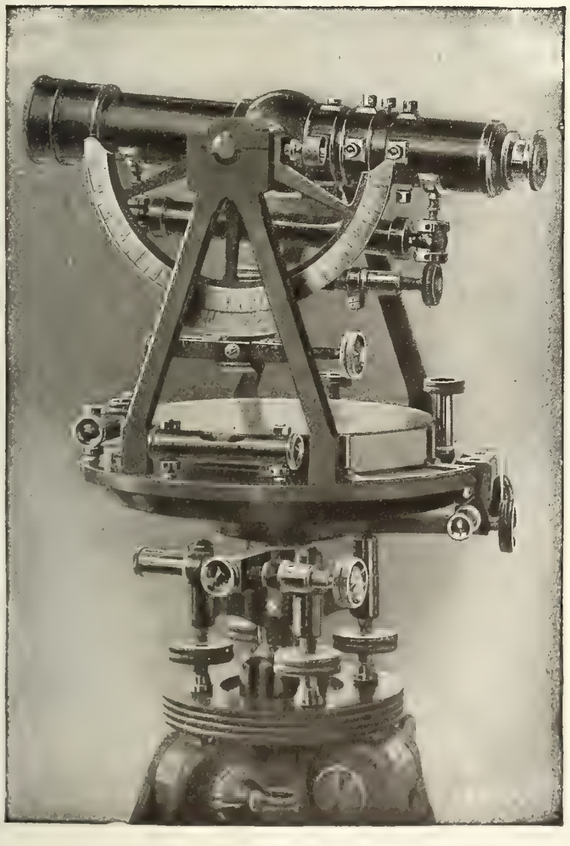

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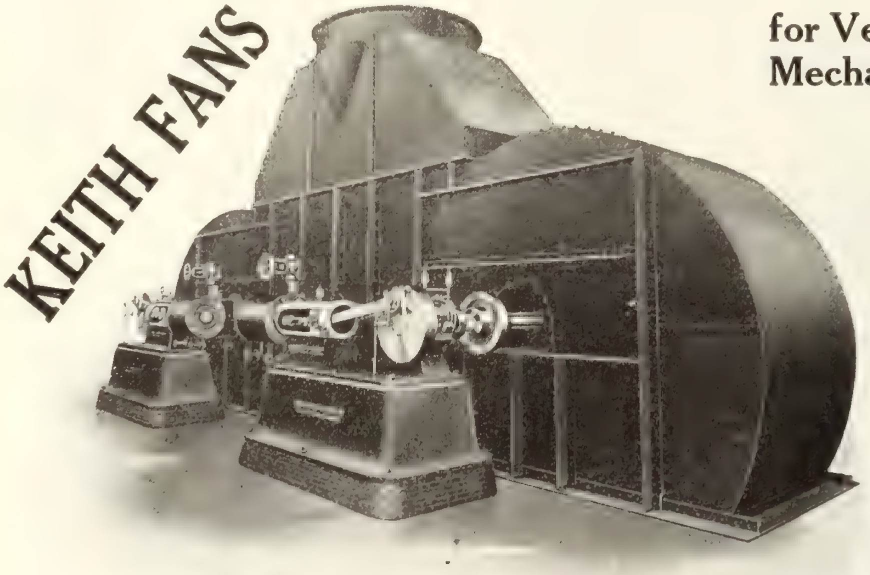

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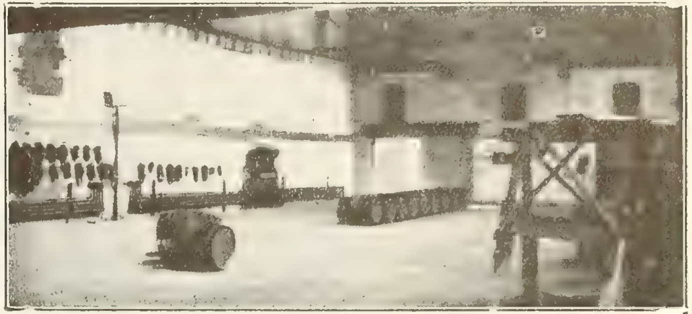

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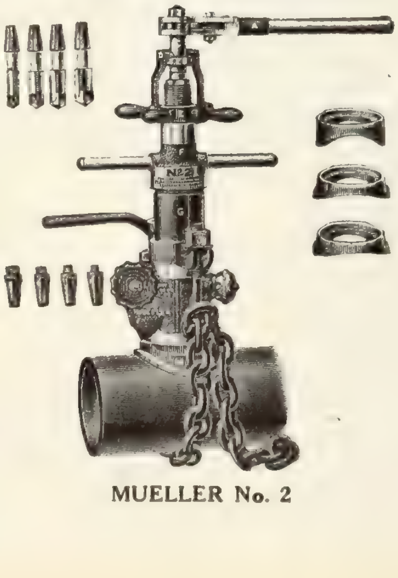

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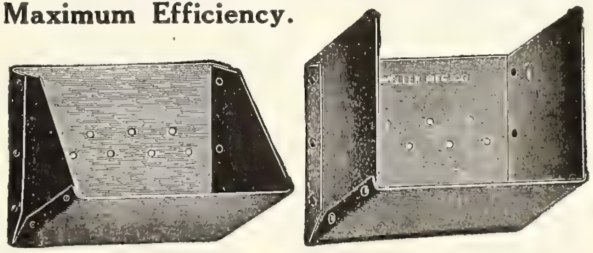

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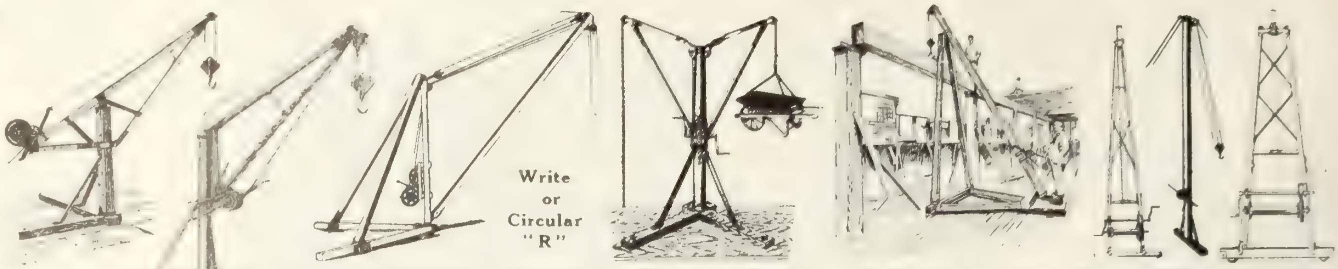

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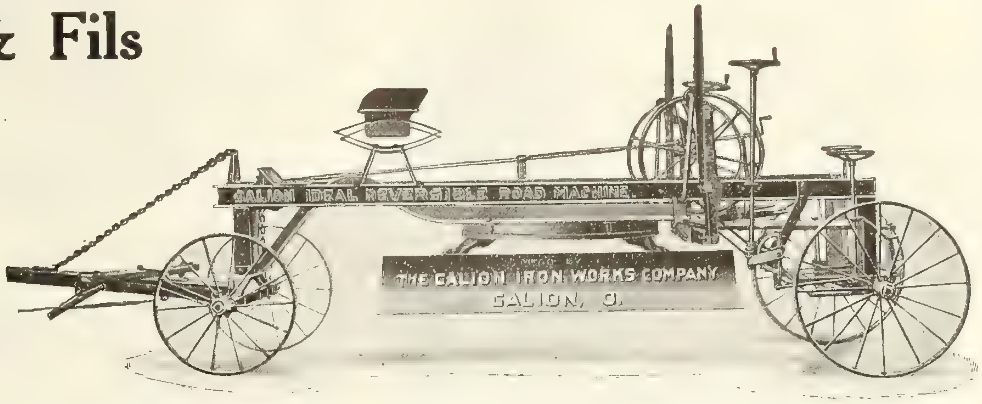
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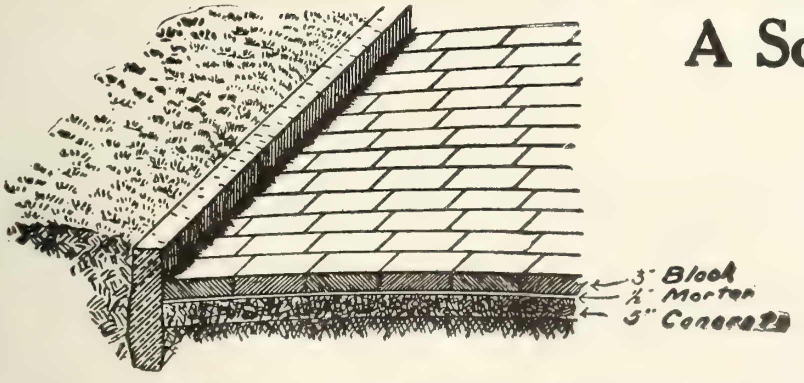

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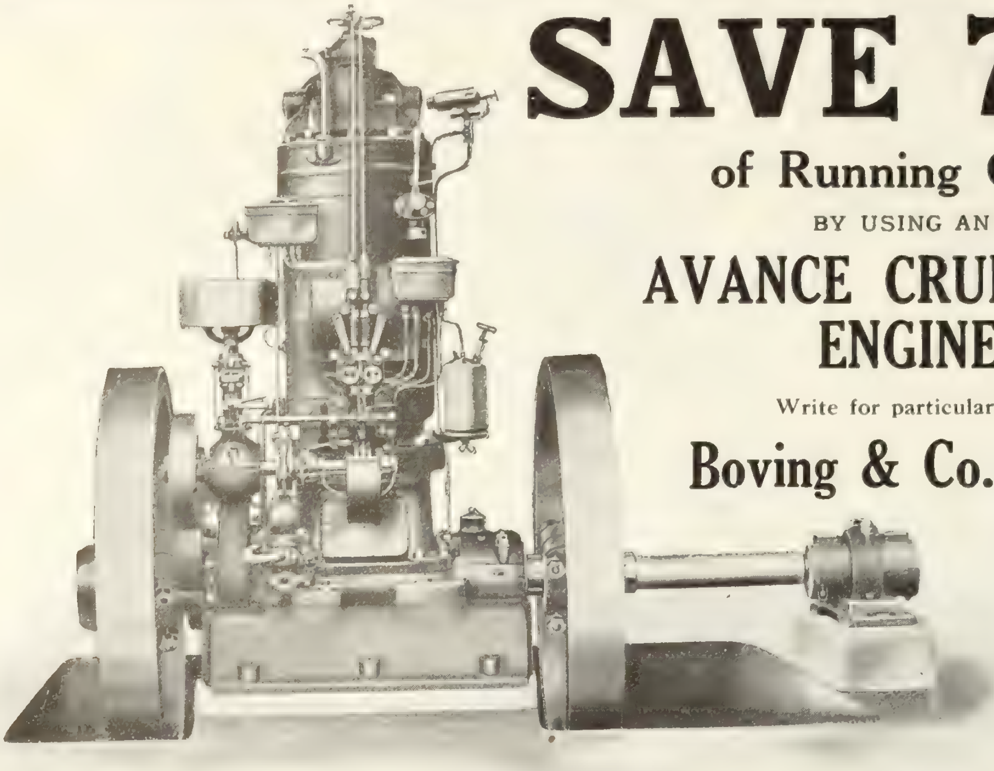

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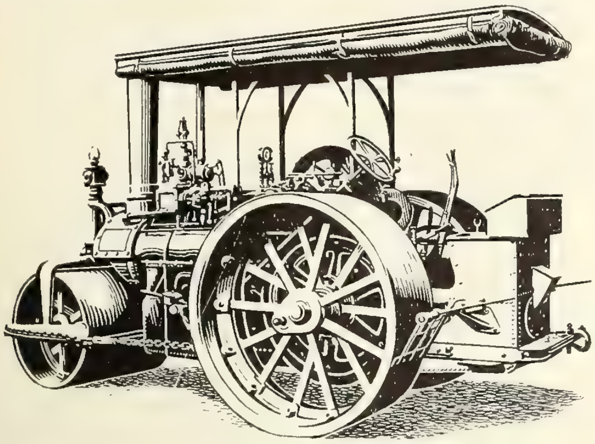

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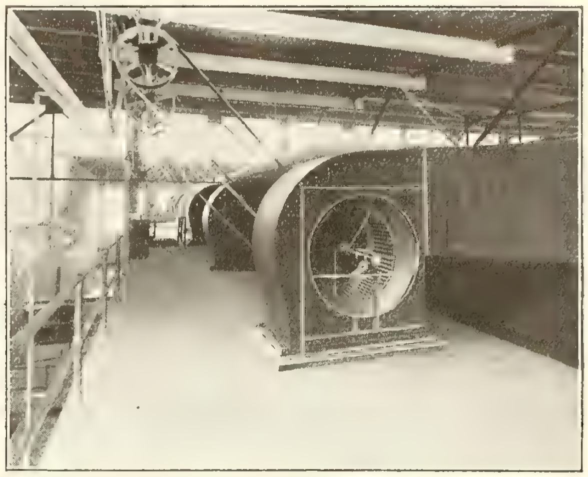

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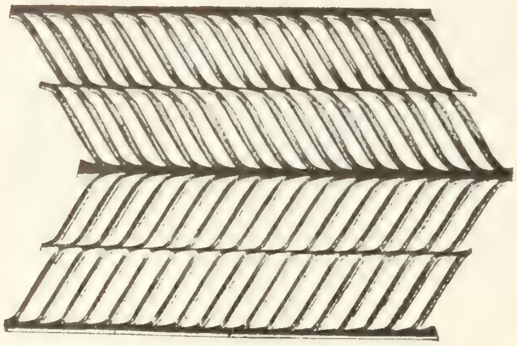

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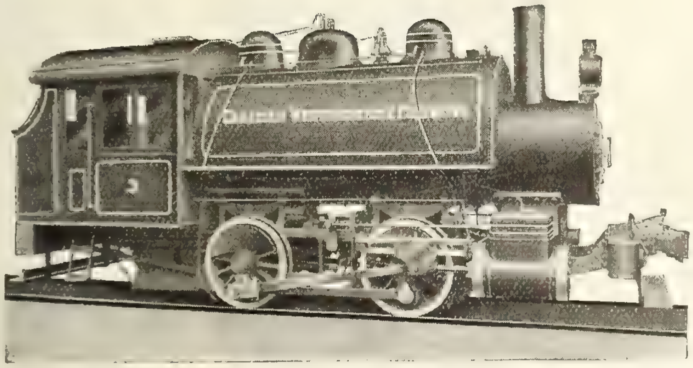

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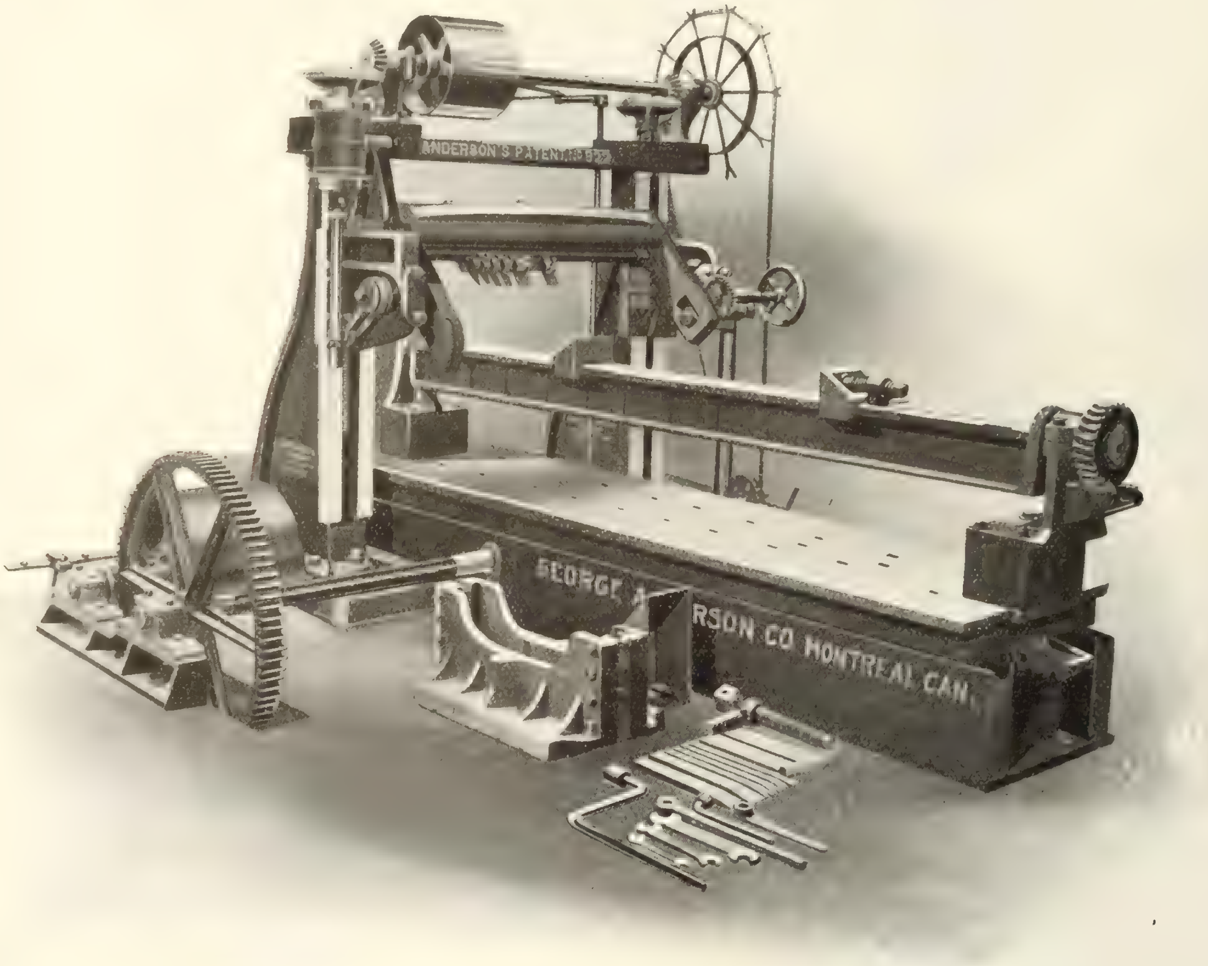

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ESTABLISHED 1886

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"Open" or "Closed" Competition?

INADEQUATE time allowance has been getting us into trouble again on the other side of the water. This time it is in connection with the proposed government buildings at Ottawa, for which architects were recently invited to submit sketch designs. The notice, or advertisement, calling for sketches, was dated at Ottawa, August 18th, but its first appearance in this journal was September 3rd, and particulars were not announced in the London, England, journals until the week of September 14th. The designs must be delivered in Ottawa not later than noon on January 2nd next, so that Old Country architects have rather less than two months in which to familiarize themselves with all the details necessary for the preparation of a design likely to engage consideration and stand a chance of success.

In commenting upon the competition our London contemporary, "The Builder," praised Canada for limiting the contest to British subjects practising within the British Empire, and expressed the hope that for the credit of English architecture an Englishman would succeed in winning the commission, showing the people of Canada that they had not "lost the best result through their loyalty to the sentiment of nationality."

This complimentary discourse was very nice, but in the following issue "The Builder" had received many complaints from architects that the Ottawa competition came at a time when two important competitions—the new Manchester Exchange and the Board of Trade Offices in Whitehall—were in progress, and that consequently many who would like to compete for the Ottawa work would be debarred. Our contemporary expressed the hope that under the circumstances the Canadian authorities would extend the time for submitting schemes for three or even six months.

We are thoroughly in accord with our London contemporary. In an important national undertaking such as this it should be our aim—and steadfast purpose—to secure the very best British product possible. It is in the first interests of Canada, as also it is in the first interests of Canadian architecture, that the selected design should have an individuality and merit paramount.

We are too hurried in such details. The announcement of such an important competition simultaneously with two other large competitions in England shows lack of foresight on the part of the authorities at Ottawa. We join our plea with the London "Builder" for the postponement of the closing date, fearful lest the impression be created that although we advertise "open British competition" we arrange our plans so nicely that the result is a foregone conclusion.

Something More Than Good Roads

GOVERNOR Ferris, of Michigan, in a recent address before the American Road Congress, committed himself to the remark that the Good Roads movement ran parallel with religious and educational advancement. The explanation was that with better roads we have fewer and better churches, and fewer and better ministers.

This is a new aspect of the question that we had not considered. It requires little reflection, however, to discover much truth in the Governor's observations. Much might be made of the point, for certain it is that hundreds of our good citizens who have shown no interest in the road movement would ally themselves with the cause of fewer (and better) ministers and churches. Governor Ferris pointed out that in New England, where good roads had been built extensively during the last few years, the amount of illiteracy was small compared with states where road work was backward.

These things are worth emphasizing. Not only are good roads indispensable to all forms of constructional development, but social, religious and educational development are impossible without them.

The great Roman Empire was founded and built up by men whose roads remain as a monument to their ability and foresight. Canada has unlimited opportunities in this field.

Great Record of the C.P.R.

OPTIMISM and progressiveness are the governing factors in the policy of the Canadian Pacific Railway, as revealed in the company's report presented at the annual meeting in Montreal. The address made by Sir Thomas Shaughnessy was brief but pregnant, containing, as it did, a masterly grouping of the important facts, a statement of what had been accomplished, and an outline of the company's policy in future development. Sir Thomas referred briefly to the high-water mark reached in the earnings of late, which, however, he said, could in no way be taken as an indication of permanent conditions. On the contrary, recent developments had been such as to give every justification for anticipating another satisfactory year.

Unparaleled progress was shown in the figures quoted by Sir Thomas Shaughnessy, who expressed every confidence in continued and proportionate growth. In ten years the annual gross income of the

C. P. R. has increased from forty-three to one hundred and thirty-nine million dollars. President Shaughnessy pointed out that the expenditures for the purpose of roadbed, equipment and general facilities need not approach those of the past, because, when the lines now being built are completed, the constructional programme may be modified. But the general activity now being created will remain, and retrenchment on the one hand will be offset by greater development on the other—moreover, the expense of maintenance is rapidly assuming enormous proportions.

The optimism and example of the C. P. R. should inspire the rest of the constructional field to greater endeavor. We can surely follow the lead of men whose belief in Canada has enabled them to build up the greatest organization of its kind in the world.

It was remarked, with significance, at the annual meeting, that the men in the Board Room represented assets of nearly one thousand million dollars.

The record of the C. P. R. is the most brilliant history of achievement of the kind ever made.

Merit of Contract System

AFTER adhering obstinately to the day labor system of doing its works for many years, the City of Fort William has discovered at last the saving that can be effected with contract work. As an experiment this season the contract system was put into operation for practically the whole schedule of improvements undertaken, and now the City admits, through Mr. Piper, Chairman of the Board of Works, that a considerable saving has been effected, both as regards time and money. Just what the saving is will not be divulged, we presume, until the annual report of the department is issued, but from the Chairman's admissions it is evident that it is considerable.

Rather curiously, at the same time we hear that there has been considerable dissatisfaction at Calgary over the cost of paving laid by the city. The ratepayers discover that a system of figuring is in operation which prevents their getting at the actual cost. If the city plant is actually laying paving as cheaply as it pretends, they ask why there should not be some explanation of the varying assessments on property. The price of asphalt paving last year in Calgary was fixed by the City at $2.10 per square yard, but the assessment levied against property for such paving is higher in cases than similar assessments against property on streets of the same width paved by private concerns.

The present administration at Calgary is defended on the ground that the estimate of $2.10 was made last year, and that it was largely speculative. After reading the report from Fort William, such arguments leave one unpersuaded still.

WE learn from a western correspondent that the City Engineer of Regina is enlisting in the "good roads" cause Boy Scouts who are now patrolling different sections of the city reporting where improvements are needed in the roads. The educational and general value of such work is tremendous, and the example of Regina might be emulated by certain eastern cities, particularly Montreal and Toronto. But the question arises: how large an army of Boy Scouts would be required to patrol the bad sections of the streets in either city? We can think of two streets in Toronto the bad spots in which would hold all the Boy Scouts in the Dominion.

Calgary Adopts Commendable Policy

IT has been the policy of a number of the Canadian cities, including Calgary, to sanction the construction of sidewalks and the installation of water mains and sewers in country sub-divisions before the latter are sufficiently built up to warrant the expenditure involved. There are many instances in the West in which modern improvements have been put in before there were any residents to use them, the advent of the latter merely following more or less slowly the accomplishment of the former. Such a policy may tend to the development of new residential districts, but it means benefiting the individual at the expense of the public, and enriching the sub-division owner from the pocket of the rate-payer. Rightly viewed, improvements should follow the populace and not the populace the improvement. The latter policy is invidious, and favors one sub-division at the expense of another.

The recent policy of the city commissioners at Calgary in putting a stop to the installation of improvements before the population of a district warrants them, is highly commendable. It leaves the growing population to extend in whatever direction it deems most suitable, and does not favor any particular subdivision. The same amount of work will be necessary under this policy as under the older one, the difference being that the work will follow settlement instead of settlement the work. It also means that the people who will benefit by the improvements will pay for them, or at least pay for a part of them, and that the real estate speculator will cease to benefit at the expense of the public. There are other Canadian cities which would do well to follow the example of Calgary.

Greater Winnipeg Water Supply

SPECIAL attention is directed to the announcement relating to the "Greater Winnipeg Water Supply," published in the Tenders Department of this issue. The important features of this great work, which involves an expenditure of $13,500,000, are set forth in the notice. Full details may be obtained and reports, maps and drawings examined at the office of the Contract Record.

October and November are about the best months of the year to examine the pipe-line route, and therefore it will be well for prospective bidders to improve the opportunity instead of waiting until winter sets in, when the country will be difficult of access. The conduit will be of concrete for about 85 miles, with reinforcement in some sections. This portion will have a daily capacity of 85,000,000 Imperial gallons. From the end of the concrete portion, at the site of a reservoir proposed for construction later on, 5-ft. steel pipe, and beyond that, 4-ft. cast-iron pipe, will lead into the city. The aqueduct will serve a few small municipalities besides Winnipeg, lately formed into the Greater Winnipeg Water District.

The record manner in which the project has been put through by the officials concerned is engaging wide attention. On May 10th Messrs. Rudolph Hering and James Fuertes, of New York City, and Frederick P. Stearns, of Boston, convened in Winnipeg. They made investigations on the ground, studied existing and subsequent surveys made by the city, and signed their report in New York on August 20th. The report was read in Winnipeg August 29th, adopted by the officials of the water district September 6th, approved by the Winnipeg City Council September 8th, and ratified by popular vote October 1st.

Tunnelling Record at Montreal Again to the Fore

On the editorial page of our issue of June 11th, 1913, we referred to a number of interesting features in connection with the Canadian Northern tunnel through Mount Royal. In the course of our observations we claimed that the record of the American continent for a heading in hard rock had been broken on June 5th, when a heading 8 ft. by 12 ft. in hard limestone reached 810 ft. in thirty working days. We contended that the previous record had been made at the Arizona Copper Mines, where a heading, 8 ft. by 8 ft., had been driven 799 ft. in thirty working days.

Shortly afterwards, Mr. E. E. Sands, of Brooks, Alta., in a letter published in our issue of July 9th, 1913, took us to task for the claims made in our previous issue, and stated that the American record for hard rock tunnelling was about 900 ft. a month, made in very hard blue shale, on the Gunnison tunnel in Colorado, built by the U. S. Reclamation Service.

For some time we have been endeavoring to collect data with a view to establishing the point conclusively, but the way is cleared for us by our Chicago contemporary, "Engineering and Contracting," who discuss the matter editorially as follows:—

Any claimant of a record in driving rock tunnel offers himself as a target. For one reason it is not agreed what establishes a record. We anticipate therefore, that the claim to the world's record for fast tunnelling, which was made in our issue of September 17th, 1913, in the article describing the Montreal tunnel of the Canadian Northern Railway, will not go uncontested. It is meanwhile worth noting what this claim is. To do this intelligently it is necessary to note the previous best record and we shall do this first for the world's tunnels and second for American tunnels. We shall further limit the consideration to hard rock tunnels. This excludes certain tunnels of the Los Angeles aqueduct which were held up two or three years ago as records of rapid rock tunnelling, but which because of the soft rock penetrated are not rightly comparable with other rock tunnels of record for fast driving.

Until claim for precedence was made for the Montreal tunnel, the world's record for fast tunnelling has been credited to the Loetschberg tunnel. Driving in limestone a heading 10 ft. wide and 6½ ft. high, a maximum month's advance of 1,013 ft. was made. At Montreal driving in hard rock a heading 12 ft. wide and 8 ft. high, a maximum month's advance of 810 ft. was made. A round of 13 holes was drilled at Loetschberg, and at Montreal a round of 18 holes was drilled; the yardage per lineal foot of heading at Loetschberg was 2.41 cu. yds., and at Montreal it was 3.29 cu. yds. The two records compare then as follows:

	Lin. ft., heading	Cu. yds.	Hole, lin. ft.
Loetschberg	1,013	2,441	13,169
Montreal	810	2,665	14,580

In this tabulation the comparison of footage of hole drilled is not quite true, first, because the actual footage drilled is not often the exact product of the number of holes by the length of heading driven, and, second, because at Montreal the number of holes per round was sometimes more than eighteen.

The best record of advance for an American tunnel previous to the new Montreal tunnel record appears to be the record of the Laramie tunnel. Driving in granite a heading 10 ft. wide and 8 ft. high, a maximum month's advance of 653 ft. was made. A round of 23 holes was drilled. From these figures we may extend the above tabulation as follows:

	Lin. ft., heading	Cu. yds.	Hole, lin. ft.
Loetschberg	1,013	2,441	13,169
Montreal	810	2,665	14,580
Laramie	653	1,933	15,019

We stated above that it is not agreed what establishes a record in rapid tunnelling. What does establish such a record? One claimant has it that record is established by maxima in yardage excavated and footage of hole drilled regardless of length of heading driven; another has it that record is established by a maximum of heading driven, although the yardage excavated and footage of hole drilled are less than in the first instance. Which basis of determination is more correct or is it more correct to integrate all three factors—footage of heading, yardage of excavation, and footage of hole drilled—and if this is more correct, why not extend the list of factors considered to include all variables?

We have set down the above figures and comments not to criticise any claims made but to indicate that in discussing tunnel records no comparisons are complete, fair and conclusive. To our mind there are features of far more general engineering interest in the Montreal tunnel work than its claim to the record of speed in driving heading.

There is first the use of the bottom heading which is quite unusual in American practice and nearly universal in European practice. Second, there is the adoption of a drill carriage, which is distinctly a European device also. It is worthy of note that the heading in which the record, which has been discussed, was made was not that in which the drill carriage worked. Instead the drills were mounted in movable arms on a horizontal heading bar. The best record made using the drill carriage was 510 ft. of heading in 27 working days. One feature of the Montreal tunnel drill carriage which distinguishes it from its European prototypes is its combination with a belt conveyor for handling spoil. The service of this conveyor is reported to have been satisfactory, and it is important that this fact be noted, for usually tunnel men look with disfavor on incumbering a tunnel heading with any large device for mucking, and in the past such devices have usually proved of doubtful service.

The Loetschberg, the Laramie and the Montreal tunnels have one feature alike, which is the use of water drills, or more accurately, drills through which alternate pulsations of water and air are forced to the bottom of the drill hole. It is interesting to note how this type of drill is gaining general use in tunnelling, and it is important to distinguish between this drill using air and water and drills using air alone or water alone for chip removal. The advantage of the combination is that air is furnished to freshen the heading atmosphere; that the combination of water with air prevents a dusty chip discharge; that the combination of air with water reduces the fogging of the heading with water vapor; that the combination current removes the cuttings more rapidly. These are all familiar claims, but they are mentioned because of a common confusion in the meaning of the term water drill.

The Montreal tunnel has structurally two exceptional features. Its flat roof profile to provide for the use of pantograph trolleys is one and the partitioning of the section into two parts by a reinforced concrete centre wall is another. The objects of these two details need no explanation. Altogether the Montreal tunnel is one of the most interesting tunnel constructions of America and it is to be hoped that its builders will on its completion give to engineers a description and analysis of methods and results which will enable a complete understanding of the worth of its several unusual structural and constructional features.

The Design of Large Bridges, with Special Reference to the Quebec Bridge—Part II.

By Ralph Modjeski, Consulting Engineer, Chicago.

WITH regard to the distance between trusses and their position relative to each other, the trusses of the new Quebec Bridge will be in two vertical and parallel planes. The distance, center to center of trusses will be 88 ft. One of the first preliminary sketches made after the board was created contemplated placing the trusses in planes inclined in the same manner as in the Forth Bridge, namely, with the tower posts converging toward the top and the bottom chords of both the anchor and the cantilever arms converging toward their respective ends. Another sketch contemplated trusses in vertical planes, but converging for the anchor and cantilever arms toward their respective ends. Both these plans would be economical in the amount of metal required in the finished bridge; but erection of a structure of this magnitude is extremely difficult, and some sacrifice of economy is necessary to make the field work as safe and easy as possible.

It was during the erection that the old Quebec Bridge collapsed. The board consulted several of the best authorities on erection of large structures, and, while their opinion differed somewhat, it was decided, after much deliberation, to make the trusses parallel throughout. In doing so we had in mind not only the erection, which was the principal consideration, but the greater simplicity of details at such important points as the pier posts and the points of suspension of the suspended span. The connections at these points become quite complicated when the anchor arm, cantilever arm, and suspended span trusses are not all in the same plane. It would have been possible to design the bridge with trusses in two planes inclined toward each other, parallel to the axis of the bridge and passing through the end supports of each truss. In this manner all connections of truss members would have been nearly as simple as in the adopted design. Such a design was also suggested and considered. But it was soon decided that the erection of heavy members in an inclined plane of the truss would be too hazardous, and this plan was abandoned.

Effect of Labor Conditions

A question may fairly be asked: Since the Forth Bridge, with its curved bottom chords, inclined and flaring trusses, has been so successfully constructed, why was it not possible to follow a similar design in the Quebec Bridge? The difference is all in the labor conditions prevailing on the two continents at the respective times of building these bridges. At the Forth Bridge 3,200 to 4,100 men were employed when the work was proceeding full swing; their number attained 4,600 for a short period. At Quebec such a large force could not be mustered. The contractors contemplate now using approximately 400 men in the field and not over 1,000, including men in the shops. In the Forth Bridge the material was all manufactured at the bridge site. By using a large force of men it was possible to build up the various members of single plates or shapes so that no heavy pieces were handled.

The admirable design, consisting principally of tubes, of which there are nearly 6 miles in the bridge, was built up by employing the method used in building boilers, piece by piece. The connections were laid out in the field, plates bent to suit, drilled and riveted on. This method of procedure would be impossible in Quebec. Not only are the men not available, but while on the Firth of Forth the climate is such that work may go on at all seasons of the year, in Quebec work aloft is impossible during more than seven months in the year. Here, then, the bulk of the work must be done by machinery to save manual labor, and must be done in the shops to permit a continuous progress. The work in the field must be reduced to the minimum or to the assembling of large pieces—as large as it is practicable to handle. The American type of pin-connected construction lends itself best to these conditions, but with that type the details will be much simpler and the erection much easier with trusses situated in two vertical and parallel planes.

System of Trussing.—The system of trussing was from the beginning the object of discussion and diversity of opinion among the members of the board; so much so, that before a definite agreement was reached it was decided to work up a plan which, though not satisfactory to all the members of the board, would, when detailed, give the first accurate estimate of weights, which would be also sufficiently accurate to serve as a start in designing any other plan of the same general dimensions. The plan thus detailed, though not approved, will be referred to as the official design.

A discussion of the proceedings among the members of the board and the government officials, which led to the ultimate result, would be out of place here. Let it suffice that, in addition to asking for tenders on the official design, the bidders were requested to submit their own designs in accordance with specifications furnished by the board. The time allotted for preparing such designs was shorter than the time it took the board to prepare the official design; but it should be remembered that the official design furnished to the bidders information which it took months of study to prepare. Not the least important information thus furnished was the estimate of weights computed from the details of the official design.

Selection of Design.—Several designs were submitted with the tenders; the design submitted by the St. Lawrence Bridge Company, with what may be called a "K" system of trussing in the cantilever arms and anchor arms, was finally recommended by the majority of the board and later endorsed by an enlarged board appointed by the Minister of Railways and Canals for the special purpose of selecting the best tender. The main reasons for recommending the design in question are given in the enlarged board's report as follows: (a) The type of design offers greater safety to life and property during erection, as well as economy and rapidity in construction. (b) The design contains the minimum number of secondary members and requires few, if any, temporary members during erection. (c) The system of triangulation, by dividing the web stresses, reduces the members to more practical sections and simplifies the details of connections. (d) The design economizes material, as shown by the calculated weights of the two designs. (e) The general appearance of the structure is, in our opinion, improved.

Uniform Deflections

There are two advantages of this "K" design which are not clearly brought out in the above reasons, and on which I wish to lay considerable stress, namely, uniform deflections and regularity of erection operations from panel to panel. The uniform deflections can best be seen by comparing the Williott's diagrams which show the deflections of the anchor arm under dead load and under dead and full live load in the old, the official, and the final designs. The deformations are, of course, on an exaggerated scale. A comparison of these diagrams will show that secondary members, or those which receive their maximum stress from partial live load only, such as the vertical suspenders carrying one panel of floor, or members which carry dead load only, such as vertical sub-posts supporting the top chord, or members which normally have no stress in them, such as struts which serve to reduce the unsupported length of main compression members, are the source of local bending in the main members to which they connect. This is because the variation in length of the secondary members as the loads are applied is independent of the variation in length of the main members. For instance a secondary member carrying dead load only receives its full deformation in length when the span is finished, but its length remains constant under any condition of live load, while the adjoining main members compress or elongate with each application of live load. In the same manner a suspender carrying one panel of the floor, for instance, will receive its maximum elongation under concentrated live load in this panel whether the remainder of the bridge is loaded or not, while the adjoining main members will receive their maximum deformation under quite different conditions of loading. The bridges are generally designed in such a manner that the secondary stresses are either entirely eliminated or largely reduced when the main members are subject to greatest direct stresses. This is done by determining the lengths of the various members, both main and secondary, in such a way that the truss, under the maximum load, will assume as nearly as possible the geometrical shape. This requires, however, an initial displacement of the main members, which during erection may be very objectionable.

The diagrams referred to show the situation as reversed, namely, as if the loads were applied to a truss having the true geometrical form. In order to obtain the true geometrical form, after the loads are applied, we should begin with a truss deformed under condition of no load.

The comparatively large distortions of the truss in the old design are due not only to greater unit stresses used but also to the cruved bottom chord and the large number of secondary members. I have explained the reason why curved bottom chords were used in that design. Of the three designs shown in the diagrams, the new design has the least number of secondary members. It should be remarked that the same advantage could have been obtained with a double intersection Warren truss by arranging the panel lengths in such a manner as to eliminate the intermediate vertical secondary members supporting the chords.

It would be interesting to know the extent of secondary bending stresses produced in the tubular bottom chords of the Forth Bridge by those vertical members, but unfortunately the necessary data for their calculation are not available.

The regularity of erection operations consists in the fact that, starting from the pier, the position of members in each panel in the "K" design is just like the preceding one, and that coupling up of members in each successive panel, as the traveller moves forward, requires the same succession of motions as in the preceding one, except that pieces become lighter as the erection proceeds. Experience shows that the oftener an erection crew goes through a series of the same motions, as, for instance, in erecting a succession of simple spans all alike, the more rapid their progress becomes.

Features of Quebec Design

Some of the more important features of the Quebec design will be of interest. The lateral wind-bracing has been omitted between the top chords of the cantilever and anchor arms. All wind forces are taken directly to the pier through substantial bracing between the bottom chords. This arrangement not only makes the distribution of wind stresses perfectly definite but permits the spreading of tracks to 32 ft. 6 in., center to center, instead of the usual 13 or 14 ft. which results in a saving in the floor system, and consequently in the entire structure. With the tracks spread, a load on one track only produces a torsion in the cantilevers, and the presence of wind-bracing between the top chords would produce undesirable and excessive stresses which would have to be taken care of by a large addition of metal to the lateral and sway systems and to the trusses.

The floor system is of carbon steel throughout. It is, therefore, stiffer than if made of nickel-steel. The long floor beams deflect less and the secondary stresses produced by their deflection are thus reduced. Even then some of the connections of floor beams to posts had to be made by means of pins. The top chords of the cantilever arm and of the anchor arm as now designed are of carbon steel eyebar. The originally submitted design contemplated nickel-steel plates riveted throughout for the cantilevers, and carbon steel plates for the anchor arms. By substituting eyebars a better design is obtained and much easier erection assured, and, although nickel-steel is replaced by carbon steel in the cantilever arm, the substitution results in a saving when both the cantilever and anchor arms are considered. Carbon steel will be used in the entire anchor arm, in the top chord and pier members of the cantilever span, in the top lateral system of the suspended span, in all the floor system and in all sway bracing. Nickel-steel will be used in the trusses and bottom laterals of the suspended span, in the trusses except top chords and pier members, and in the lateral system of the cantilever arm. The anchor bars which hold down the ends of the anchor arms have been made very long to reduce bending stresses from expansion.

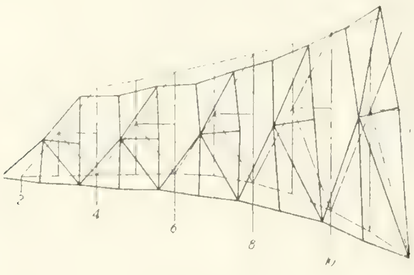
The suspender eyebars which support the suspended span are subject to oscillation in the plane of the trusses, due to expansion. A total expansion of 16 in. must be taken care of at these two points of suspension, besides the extension of the bottom chords under the live load. Manganese bronze bushings will be provided in these eyebars to permit of easy turning on the pins. But, even should these fail to turn, there is sufficient metal in these eyebars to prevent overstress from bending.

Friction brakes will be installed to prevent excessive longitudinal oscillations of the suspended span under tractive forces of trains.

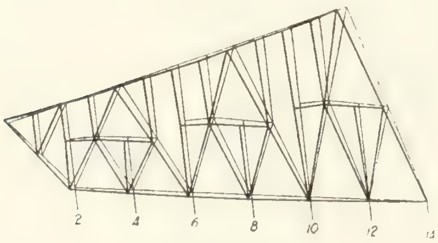
All latticing of compression members is designed in proportion to the sectional material of each member. The latticing is made strong enough to transmit in transverse shear 2 per cent. of the direct stress of the member.

Determination of Dead Load

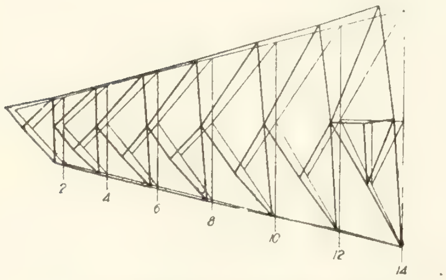
After the designer has determined the principal dimensions and has designed the skeleton outline of the bridge, the next necessary step is to calculate the stress sheets and proportion the various members. Assumptions must first be made on the dead load of the various portions of the span. In simple spans and in suspension bridges a first assumption of a uniform load per foot is generally sufficient except in very long spans, in which the concentrated loads should be calculated after the details are designed, and the sections should be checked and modified if necessary. In cantilever structures the distribution of the dead load is quite far from uniform.



Phœnix Bridge Company's design.



Official design.



St Laurence Bridge Company's design.

DEFORMATION DIAGRAMS OF QUEBEC BRIDGE

Live load reversed. Scale of deformation is 120 times greater than scale of truss.

The Forth Bridge weighs 2 tons per foot at the center of each span and 13½ tons per foot near the towers. The new Quebec Bridge weighs 8.7 tons per foot near the center and 38 tons per foot near the piers. The original Quebec Bridge was underestimated—the calculated dead load stresses were too small; it was to guard against a similar error that the official design of the new bridge was worked out in detail before even the system of trussing was quite agreed upon.

In calculating the weight of a span from the known weight of a shorter span it is customary to assume that the total weight of steel in trusses and bracing increases as the square of the span. This rule of thumb is sufficiently correct for small spans, not to exceed 200 or 300 ft. in length, but is obviously wrong for very long spans. If it were true for all spans, then a span 100,000 ft. in length could be built by providing 100 times more metal than a span of 1,000 ft. would require. We know that a span of such length is impossible with materials now known and that it would fail under its own load. As a matter of fact, in a cantilever system of the size of the Quebec Bridge the weight of the steel increases more rapidly than the cube of the length. This power or exponent increases still further for longer spans until it becomes infinite for a span which is just long enough to carry its own weight only at the allowable unit stresses without being able to carry any live load.

The principal dimensions being fixed and the preliminary stress sheets calculated, the details of the structure must be worked out. Needless to say that all these determinations which I have mentioned as taking place in succession are correlated to each other, and frequent retracing of one's steps is necessary before the detail plans are matured. The general order of procedure, however, is always about as described.

Bottom Chords.—The bottom chords of the anchor and cantilever arms and their details were the subject of a great deal of study and of many tests. Little is known about bridge compression members when compared to tension eyebars. The Quebec compression chords are members of unusual size. It is only in work of great magnitude that the engineer has an opportunity to make tests on a large scale; the expense of such tests is trifling in comparison with the importance to the structure of the results obtained. It is not sufficient to know that in some bridges a compression member is still standing and is subjected to a certain stress. What we should know is how much greater stress it would take to destroy that member. Such a member may be in the stage of danger from the last straw. The board made a number of tests on models of chords and posts, both for the official design and for the final one. The tests gave generally better results for model members representing the latter. The board feels, therefore, that a good design for these heavy members has been obtained.

There never was any serious doubt among the members of the board as to the advisability of making the bottom chords of the anchor and cantilever arms rivetted throughout without pin joints, except at the main pier bearings, to avoid excessive secondary stresses. This was done and will result in a stiffer bridge.

Top Chords.—The original design as submitted by the St. Lawrence Bridge Company contemplated top chords built of plates entirely. While this was approved at the time, later studies proved that by building the top chords of carbon steel eyebars there will be a slight saving of weight and cost, and the change was authorized. A tension member built of eyebars is the most reliable type by reason of the large number of full-size eyebar tests which have been and are constantly being made. It is the logical form of construction for transmission of tensile stresses. Their use reduces the secondary stresses. In a chord built up of wide plates with riveted joints, making it continuous, the secondary stresses resulting from bending due to the deflection of the span would be considerable, but owing to the uniform deflection of the "K" design they could easily be taken care of.

One of the guiding principles of the designers of the new Quebec Bridge was the elimination of untried features and experiments. In a span of this length some new features must necessarily be introduced, but they are limited to those only which grow out of the unprecedented length of span.

Suspension Bridges.—With the length of the Quebec span of 1,800 ft. and with the materials now at the disposal of the engineer, the practical limit of cantilever construction has very nearly been reached. In fact, if economy alone is to be considered, a cable suspension bridge would have been cheaper for a span of 1,800 ft. The cantilever structure presents a greater rigidity under moving load, and this greater rigidity was the determining factor in the decision of the board to adhere to the cantilever type. Tentative plans of the suspension type with wire cables were, however, partly worked out by the board in the way of study.

The comparative rigidity of the cantilever system on one hand and the suspension type on the other may be gauged by the deflections at the center of the span under full load.

Deflection at Span Center, Full Load

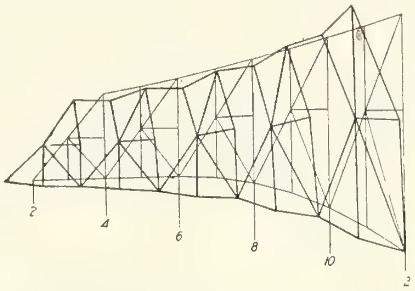
New Quebec span, total live load . . . . 11¾ in.
Cable suspension bridge, trial design—live load only, over . . . . 2 ft.
Cable suspension bridge—with 120 deg. variation in temperature and full live load—between highest and lowest position, about. . 7 ft.

There are two reasons for the large deflections in suspension bridges—first, the deflection due to variations of temperature in the cables of a suspension span, which in a cantilever span is inappreciable; and, second, the fact that higher unit stresses are permissible in the wires of the cable than in the members of the cantilever span. The working unit stress in the wires is generally taken at from 55,000 to 60,000 lb., while less than one-third of this is permissible in rolled carbon steel.

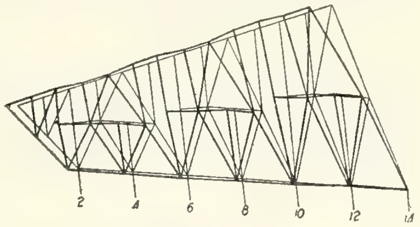
Moving Load

When a moving load travels on a suspension bridge it subjects it to partial deflections which may be compared to a wave motion. This motion is greatly obviated by the use of deep stiffening trusses. The deeper those trusses are, the smaller will be the partial deflections. It is, therefore, an advantage to make these stiffening trusses as deep as practical considerations will permit. But, on the other hand, the deeper the truss the more equalizing will it perform and, therefore, the heavier will it have to be. Each particular case must be studied in this respect, taking into consideration the relative importance of the live load which produces these local deflections to the dead load. A suspension bridge generally consists of one main span and two side spans. There are two distinct types of side spans—one where these side spans are suspended from the cables,, as in the Manhattan bridge in New York, and one where they are supported independently of the cables, as in the Williamsburg Bridge in that city. There are also two types of stiffening trusses for the main span—a continuous truss, as in the Manhattan Bridge, and a truss hinged at one or more points, as in the Brooklyn Bridge. For a bridge for highway and street car traffic, even though interurban trains are to use it, the most suitable type is the one with comparatively shallow stiffening girders continuous over the main span, with side spans suspended from the cables; this because of the absence of concentrated moving loads which would be heavy enough to cause appreciable local deflections. On the other hand, a bridge for railroad use, single or double-track, should preferably be built with deep stiffening trusses over the center span, hinged at center or continuous, with side spans supported independently of the cables. It is perfectly practicable to build an efficient and economical suspension bridge for railway use if these principles are adhered to.

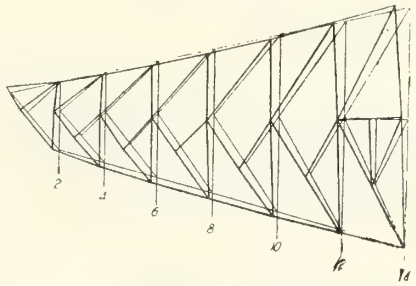
The main parts of a suspension bridge are the cables. These are sometimes replaced by eyebar chains. The longest eyebar suspension bridge is in Budapest and has a span of 981 feet. The longest cable span is 1,600 feet, and the one built by Roebling Brothers is still giving excellent service. There is no doubt, therefore, that the wire cable has been successful for long spans. It is doubtful if an eyebar chain suspension bridge of 1,800-ft. span would prove economical as compared with the cantilever type unless some special steel with which we have had little experience be used. The impact from moving load in the chain would be within 10 per cent. of the impact produced in the top chords of the cantilever arms, so that much higher unit stresses in eyebar chain links than those used in eyebar top chords of the cantilevers would not be justified. The allowable working stress in cables is not less than 55,000 lb. per square inch, while it is not over 30,000 lb. in nickel-steel eyebars, or a little more than one-half.



Phœnix Bridge Company's design.



Official design.



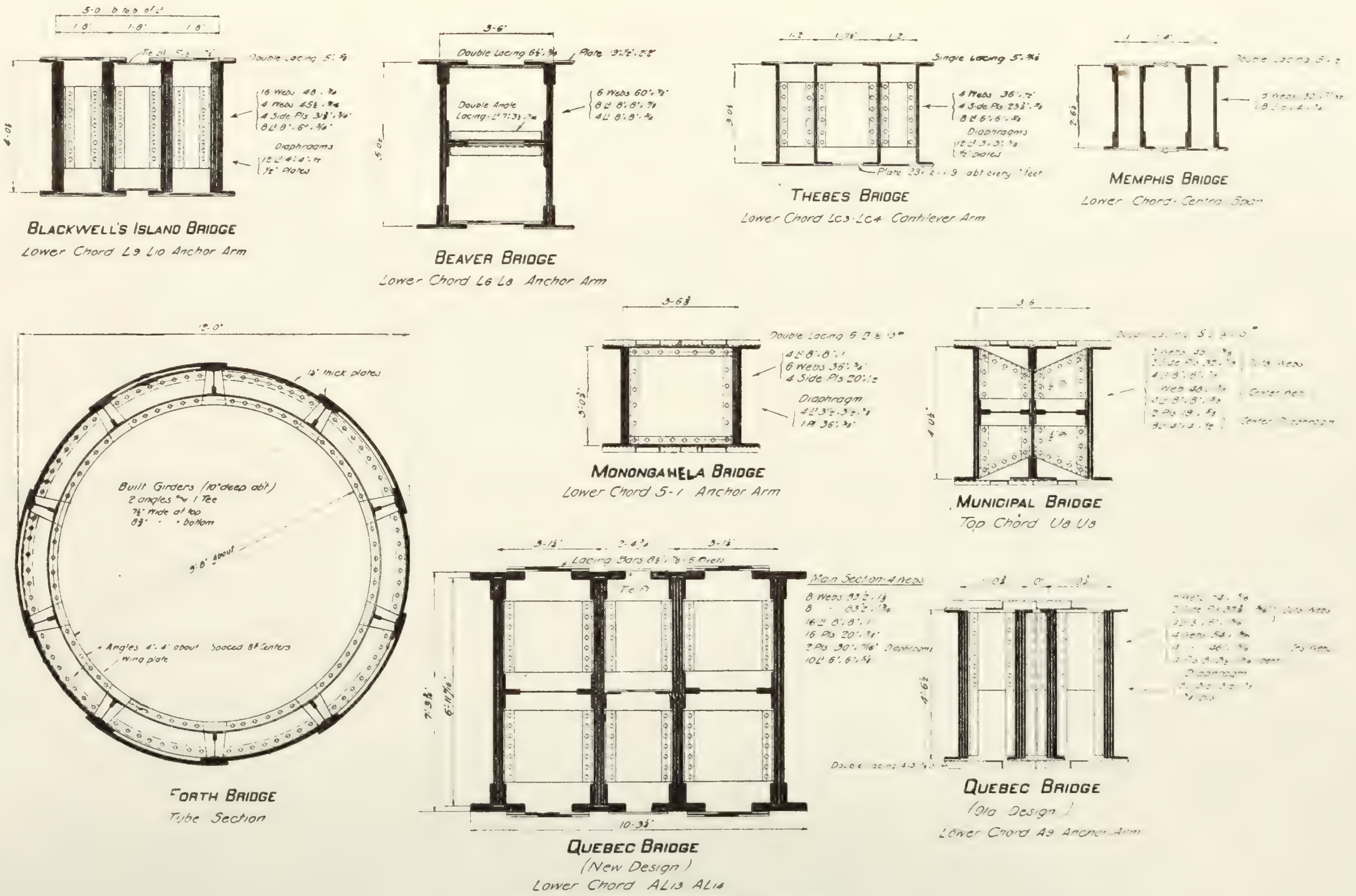
St. Laurence Bridge Company's design.

DEFORMATION DIAGRAMS OF QUEBEC BRIDGE

Dead plus live load reversed. Scale of deformation is 60 times greater than scale of truss.

Span Limits

From what was said throughout this paper it is obvious that the longer the span the greater the need of materials of high resistance. For plate girders and short spans ordinary medium steel does very well and is used exclusively; for longer spans, beginning with



Sections of large compression members.

400 feet, alloy steel, such as nickel steel, nickel chrome, vanadium, etc., may be used to advantage, this advantage increasing with the length of span. The practical limit of cantilever system for known materials is reached at about 2,000 feet for a railroad bridge. For longer spans, suspension bridges should be used, and are made possible by the high resistance of wire cables. The practical span limit of a wire cable suspension bridge has been calculated at 4,335 feet, assuming a working stress in the cables of 60,000 lb. per square inch.

The breaking load of the cables was assumed at 180,000 lb. per square inch. If an alloy wire be used of a still higher resistance the practicable limit will exceed the one given above. The limit of a cable alone without any load except its own, stressed at 60,000 lb. per square inch, is 15,160 feet. This assumes the versed sine of the cable to be ⅛.

An eyebar chain of alloy steel, such as now in use, should not be stressed beyond 30,000 lb. per square inch. Assuming this stress and a versed sine of ⅛, the limit of length of such a chain will be 7,010 feet. Hence, the limit of span length of an eyebar chain suspension bridge to carry live loads would be considerably below that of a cable suspension bridge.

The suspension design lends itself better to graceful treatment than a cantilever bridge, and may often be preferred for ornamental highway bridges even where a cantilever would make a cheaper bridge.

Considering the purely utilitarian structures, such as the majority of railroad bridges, the present knowledge of metals and its alloys, and the present loadings, we may sum up the various types of large bridges as follows:

For span up to 750 ft.	Simple spans
For spans from 650 ft. to 2,000 ft. . .	Cantilever spans with suspended span.
For spans from 1,500 ft. to 4,000 ft. . .	Cable suspension spans.

Arch spans have their place only where natural conditions are favorable, or for ornamental bridges.

Chain suspension bridges may be used for ornamental highway or city bridges, but for railroad service and for spans below 1,500 ft. the cantilever is to be preferred as giving a stiffer and generally a cheaper structure.

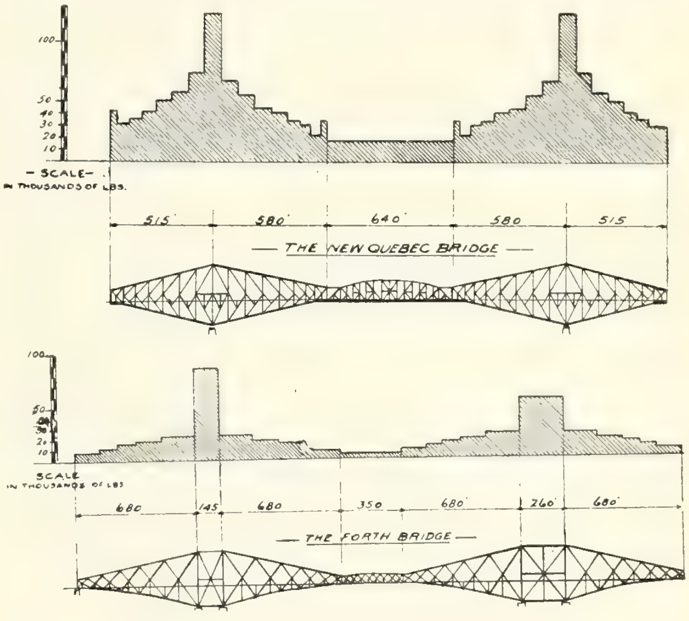
It will be noticed that the above limits overlap. Local conditions in each particular case will be considered in deciding whether a span between 650 feet and 750 feet should be simple or cantilever, or whether a span between 1,500 and 2,000 should be cantilever or a suspension span.

Secondary Stresses.—I shall not dwell long on this latest addition to bridge calculations. That secondary stresses exist is a fact. They may be from three sources: First, weight of member; second, temperature; third, bending from loads.

In the new Quebec design all secondary stresses were calculated and taken care of, but as a result of tests made by the Quebec Board, the stresses in tension members due to their own weight will be neglected. It is quite possible that if similar tests could be made for other secondary stresses it would be found that the metal adjusts itself to a large extent in such a manner as to reduce the importance of those secondary stresses and their influence on the elastic limit of the member. Personally, I feel there is a tendency at present to overrate the importance of secondary stresses. They should, of course, be considered in designing a structure; it should be the aim of the designer to reduce these secondary stresses to the minimum, but excessive refinement should be avoided, and unit stresses for direct loads should be made low enough to include these secondary stresses where they may exist.

Materials

The proper selection of materials for a structure is an important part of the design. The ordinary commercial steel will do for rough plate girder work, but for large bridges a metal of higher quality should be used. The metal or alloy should have a high elastic limit, a high ultimate stress, and possess sufficient ductility, which is characterized by the elongation and the reduction of the cross-section of specimens tested, to allow its being worked in the shops without fear of injury. Here, perhaps, climatic conditions should be mentioned. Intense cold makes steel brittle. This is shown by the greately increased number of rail fractures during severe winters. The use of high carbon steel should therefore be avoided in northern climates. The behavior of the various alloys in freezing weather needs yet to be studied.



Diagrams of weights per foot of bridge.

In all that precedes I have endeavored to avoid speaking of matters which are usually given in textbooks. I have also avoided mathematical deductions, leaving them to better mathematicians, and I have attempted to deal with this vast subject from a practical standpoint only. When the final report of the Quebec Board is published it will give in detail what I have merely been able to outline. Numerous most interesting tests and mathematical analyses have been made and will be published in the course of events. It will then, perhaps, be realized, even by the members of the engineering profession who had no opportunity to design a very long span, that, while it is very easy to draw a diagram and a few of the principal details, it takes months of study, of retracing one's steps, of tests and calculations, to make a complete design and to learn that the preliminary diagrams and sketch details must often be changed entirely to make a practicable and an efficient structure.

Remodelling sewage works at Manchester, Eng., is involved in a plan contemplating the expenditure of $5,000,000, according to a recent report. It is proposed to alter the Davyhulme sewage works, which have an area of 221.5 acres.

Market in Australia for Canadian Asbestos Lumber or Asbestos Cement Flat Sheets

IN a comparatively recent period, a rapidly increasing demand has arisen in Australia for asbestos flat sheets for building purposes. So far it may be stated that this material is passing successfully through the trial or initiatory stage. When the Australian people become better acquainted with the advantages to be derived in using asbestos sheets, under certain climatic and other conditions, in preference to wood and other materials, the trade is sure to show marked development. In tropical and sub-tropical Australia asbestos sheets will, in the opinion of experts, supply a much desired want by providing a cheap and enduring building material, not only easy to erect but also impervious to wind and water and unaffected by high atmospheric temperatures. The greatest curse of many parts of the Commonwealth is the ravages of white ants, which rapidly eat up and destroy any wood structure they succeed entering into. At the present time numbers of suburban villas and country cottages are being faced with asbestos sheets and their roofs covered with asbestos shingles. Ready to erect and portable motor car garages composed of almost entirely asbestos materials are being constructed, and this applies to buildings of other character.

From investigation made it appears that Canadian manufacturers of asbestos lumber have not yet submitted quotations to Australian buyers to meet competition from the United Kingdom and the continent. Canada is the largest producer of crude asbestos, and it seems an anomaly that manufacturers of the finished product in the Dominion, with shipping facilities almost at the doors of their factories, are (through some inexplicable reason) unable to capture some of the Australian trade. The explanation may be in the active domestic demand; surely it cannot otherwise be attributed to inability to compete or indifference to oversea trade.—D. H. Ross, Canadian Trade Commissioner, Melbourne.

Simplified Bridge Design

The channel piers of the Hawthorne Avenue lift bridge, Portland, Ore., are pairs of concrete cylinders connected at the top by reinforced-concrete vertical diaphragms transverse to the bridge axis. They support tall steel towers carrying the counterweights and ropes for operating the lift span. The vertical tower columns are in the planes of the bridge trusses, but are braced by inclined posts in vertical planes transverse to the bridge axis. The lower ends of these braces are supported on long reinforced cantilever extensions or solid web brackets projecting from the up and down stream sides of the pier cylinders. This construction simplifies the structural steel work, without increasing the volume of submerged substructure, and requires a minimum of reinforced concrete. Messrs. Waddell & Harrington, of Kansas City, were the designing engineers.

Hardening Steel by Compressed Air

A process whereby steel is hardened by means of compressed air is now in use by a German firm in cases where only certain parts of the metal require hardening. The customary methods of hardening by chilling the steel in water, oil, or special baths is not satisfactory in such cases, owing to the tension created between the hardened and unhardened portions of the treated metal. In the new procedure the compressed air is sprayed over the metal through specially designed nozzles, by means of which, by varying the number and spacing of the openings, the degree of hardening may be accurately graded. The claim is made that a wide range of results can be obtained by adapting the shape of the nozzle to that of the work.

Massive Proportions of Panama Locks

The massiveness of the Panama Locks was graphically depicted in a lantern slide presented by Mr. William McNab, principal assistant engineer of the Grand Trunk Railway and past president of the American Railway Engineering Association, in the illustrated talk he gave at the president's reception at the recent convention of the association. The view showed a cross-section of the side wall and floor of one of the locks, with a pigmy man standing on one of the steps of the back wall. In the lock was an imaginary six-storey building, the top of which was about even with the top of the wall. In the circular section of the culvert in the base of the wall appeared the front of a locomotive, and in the longitudinal section of the transverse feed pipe was a team of horses with a truck.

Proposed Large Suspension Bridge

Up to the present time the Williamsburg Bridge over the East River between Manhattan and Williamsburg is considered the largest structure of its kind, with a span of 1,600 ft., having six tracks, two drives and two sidewalks. In a lecture before the Liverpool Engineering Society Mr. L. H. Caase proposed the construction of a larger bridge across the Mersey River at Liverpool, and gave arguments to prove the feasibility of the scheme. The proposed bridge would have a span of 2,660 ft. and a width of 50 ft.; the height above the water surface would be 200 ft., the towers being 490 ft. high. The live load on this bridge would only be a fraction of the heavy traffic that the Williamsburg Bridge has to carry. It is calculated that the bridge would accommodate about 600 cars and carriages per hour. At the towers the cables would be spaced 100 ft. apart, and they would be braced at the vertical center of the wind pressure. This would cause a slight torsion in the structure for eccentric loadings.

A note worthy arrangement is that of the approaches, which are designed have a length of 335 ft. and form a helical curve with four and one-half windings. This helical roadway is supported on a reinforced-concrete tower of 200 ft. inside and 300 ft. outside diameter. It is estimated that the structure proper would cost about $4,000,000.

Franklin Rods

New lightning conductors have been installed on St. Paul's Cathedral. In the course of the operations part of one of the original iron bar conductors erected more than 140 years ago under the supervision of Benjamin Franklin was discovered. This bar, having been inside one of the towers and so not exposed to the weather, was still in a good state of preservation. The Times recalls that the fixing of these "Franklin rods," as they were called, led to a heated controversy as to whether lightning conductors should have points or balls as terminals. The President of the Royal Society, who advocated points, had to resign. King George III. was a strong adherent to ball terminals.

Separate and Combined Sewers in Their Relations to the Disposal of Sewage

By John H. Gregory, Consulting Engineer, New York

IN the construction of a new sewerage system, or of new sewers, one of the problems which first arises is the question whether the sewers shall be built on the combined or on the separate system, or partly on both. The question often cannot be answered without careful study, as consideration has to be given to numerous factors. Two factors of the greatest importance are the questions of cost and of sewage disposal. It is the purpose of this paper to discuss briefly some phases of the subject as well as some of the relations which the sewers bear to the problem of sewage disposal.

As a general proposition, where both sewage and storm water are to be removed in artificially constructed channels, it is probably safe to say that the cost of building a combined system, in which both the sewage and storm water flow in the same channel, generally spoken of as a combined sewer, is less than that of constructing a separate system, in which the sewage flows in one set of pipes, frequently called sanitary sewers, and the storm water in another set, called storm water drains. This is especially true where the territory to be served is more or less closely built up and the streets are already surfaced or paved.

On the other hand, in suburban territory, not closely built up and not likely to be so built up in the near future, and where storm water is easily and quickly diverted into natural water courses, the separate system will in general cost less for the reason that only the sanitary sewers need be built at first, the construction of the storm water drains being deferred for a period of years, or only such drains built as are immediately required. The cost of building a combined system in such a territory might easily be so great as to be actually prohibitive, whereas the construction of the sanitary sewers of a separate system, as just outlined, could be carried out and would serve all requirements for a considerable period of time.

Topographical Considerations Important

One factor, however, should not be overlooked and that is the character of the topography. With steep grades and relatively high velocities in the sewers it might prove more advisable, on account of the relatively small additional cost, to build combined rather than separate sewers, although the character of the development of the territory might hardly be such as to require the removal of the storm water by this means.

In narrow streets and in congested districts combined sewers have an advantage in that only one sewer is required, thereby reducing to a minimum the amount of sub-surface obstructions. True, the combined sewer will be slightly larger than the corresponding storm water drain which would be required, but the increase in size of the latter is generally so small as to be of little importance. With the separate system, however, two pipes are required, and sometimes three, when a sanitary sewer is laid on each side of the storm water drain, this condition being forced when the storm water drain has to be built so close to the surface of the street as to prevent the carrying of house connections over it.

Again, with the combined system, but one house connection is needed, whereas with the separate system, especially in closely built up districts with paved yards and areas, two are required, one for the removal of the sewage and the other for the removal of the storm water from roofs, paved areas and other impervious surfaces. The practice of discharging storm water across the sidewalks to the gutters is not one to be recommended. The storm water is, however, sometimes removed by pipes laid just below the surface of the sidewalk and discharging at the gutter. Such pipes frequently give trouble, and often would not be low enough to drain paved areas adjacent to or in the rear of buildings. Two house connections, of course, cost more than one but not necessarily twice as much as one.

With a combined sewer laid in the middle of the street, as is generally the case, the cost of the house connections to the abutting property owners on each side of the street is equalized. With a separate system the cost of the house connections may be greater to the property owners on one side of the street than on the other unless the sanitary sewer and storm water drain are equally distant from the center of the street. If the connections to the curb or property line are put in at the expense of the municipality the cost to the abutting property owners as a whole is as nearly equalized as possible.

Combined sewers are generally laid on flatter grades than separate sewers and may increase the area which can be served without pumping. They may even eliminate pumping entirely. It sometimes happens that combined sewers can be advantageously adopted for a part of the system and separate sewers for the remainder. The writer has in mind one of the large cities in the east where no pumping is required and in which three-quarters of the city is sewered on the separate system and one-quarter on the combined system. The section of the city sewered on the combined system was too low to be sewered on the separate system without pumping and it was in order to avoid pumping that this section of the city was sewered on the combined system.

Higher velocities are required in combined sewers in order to prevent the deposition of grit. Velocities which would be permissible in sanitary sewers would not give satisfactory results in combined sewers. Deposits would be likely to accumulate, especially if a great variation existed between the minimum rate of dry weather flow and the maximum rate of storm flow. When deposits occur in combined sewers, organic matter is likely to be held back and settle out or become stranded. If putrefaction of this organic matter takes place before it is washed away, malodorous conditions arise. With a long-continued very low dry-weather flow, deposits may cause the sewage to be ponded, with the result that the sewage may become stale, or possibly septic. a condition which should by all means be avoided, independent of whether the sewage is to be treated or not.

Disposing of Sewage

So far the subject has been considered without reference to the question of sewage disposal, but one of the most important factors of all is what is to be done with the sewage after it has reached the sewers. If the sewage is to be discharged into a body of water without any treatment whatsoever, a condition less and less likely to arise in the future, combined sewers would frequently offer the simplest and cheapest solution of the problem. If, however, the sewage is to be treated, separate sewers have certain advantages. In order to limit somewhat the scope of the paper it will be assumed that the sewage must receive some treatment before final discharge and that the treatment will be at one point. Further, that ample opportunity is afforded for the discharge of storm water without having to carry it any great distance.

Sewage treatment works cost money. It is therefore desirable to keep them as small as possible, and in order to do this the volume of liquid to be handled must be kept at a minimum. Rarely, if ever, would it be the case that all of the storm water would have to be treated; hence in this discussion the question of treating other than the first wash of the streets, in addition to the sewage, will not be considered.

With a separate system the volume to be handled at the treatment works is the total sewage flow in the sanitary sewers. The liquid is made up of house sewage, ground water leakage and trade wastes. The flow may, however, be increased in times of storm by taking in the first wash of the streets from the storm water drains should it be found necessary or desirable to treat the first wash.

With a combined system, under dry weather conditions, the volume to be handled ordinarily is what is commonly spoken of as the dry weather flow and is also made up of house sewage, ground water leakage and trade wastes. In times of storm, however, the flow in the combined sewers is increased by the storm water from the streets. The liquid then consists of a mixture of house sewage, ground water leakage, trade wastes and storm water.

The effect of the storm water in combined sewers is two-fold—it not only increases the volume of liquid flowing but it changes its character. The first wash from the streets is often exceedingly foul and may increase the organic content of the liquid flowing in the sewers, giving what may be called a stronger sewage. As more and more storm water enters the sewers the storm water becomes cleaner and cleaner and with the greatly increased flow in the sewers the organic content of the liquid is decreased, resulting in what may be called a weak or dilute sewage.

The volume of liquid to be handled at the treatment works from a combined system depends on whether only the dry weather flow or the dry weather flow plus some storm water is to be intercepted. If only the dry weather flow is to be intercepted then the volume to be handled at the treatment works would, in general, be substantially the same from the combined system as from the separate system.

A Fundamental Difference

One fundamental difference between the two systems, however, exists. With the separate system no raw sewage escapes to the streams or water courses, while with the combined system raw sewage must at times be discharged into them. If it is planned to intercept only the dry weather flow, then, during storms, just as soon as the flow in the combined sewers exceeds the maximum rate of dry weather flow, the surplus flow, over and above that which can be intercepted, escapes, with the result that a mixture of sewage and storm water must reach the streams.

It is true that the overflow of raw sewage from combined sewers into the streams ordinarily would take place only during periods of storm, but even the occasional discharge of raw unscreened sewage into a stream is a question which must be carefully considered. It might be the case, and probably often would be the case, that as far as the temporary reduction of dissolved oxygen in the stream is concerned no harm would be done, but floating particles of paper and faecal matter are offensive to the sight. If, however, the stream into which the overflow of sewage would take place is sluggish and with but little velocity it may easily be that the continued overflow of sewage into it, from time to time, with the accumulation of sludge deposits on the bottom, would lead to offensive conditions.

While considering the question of the overflow of raw sewage from combined sewers, one point of view of the public should not be overlooked. In general, the public knows but little of the difference between the separate and the combined system. They know that sewers are needed, that the sewage must be treated before being finally disposed of and that a disposal works must therefore be built. Their natural inference is then that all of the sewage will be treated at all times. If the separate system is adopted, well and good. But if, instead, the sewers are built on the combined system and the public sees raw sewage, even if dilute, discharged into the streams from time to time will they be satisfied? And again, will the state authorities be satisfied? The question is one, aside from dollars and cents, which should and must receive the most careful consideration.

With a combined system, in order to reduce the number of times during the year that raw sewage would have on the sewage treatment works would be to increase their size, and consequently their cost, over and above that which would be required if the separate system had been adopted.

If it is found desirable or necessary to intercept and treat the first wash from the streets the separate system is more advantageous than the combined system as by its adoption no overflow of raw sewage to the streams will take place. The storm water drains receive only storm water and the first wash from the streets can be intercepted in the storm water drains and discharged either into the sanitary sewers, or into the intercepting sewer leading to the treatment works. As the flow in the storm water drains increases, the surplus water, over and above that intercepted, overflows to the streams but carries no sewage with it.

The separate system, under certain conditions, offers greater flexibility in the disposal of trade wastes than does the combined system, unless the first wash of the streets is to be intercepted and treated. Some trade wastes are offensive and if discharged into the sewers in such a condition must be treated. On the other hand some trade wastes are inoffensive and can be discharged direct into the streams without causing any nuisance or trouble.

With the separate system the offensive trade wastes can be discharged into the sanitary sewers and the inoffensive wastes into the storm water drains. The offensive trade wastes only would then be carried to the treatment works. With the combined system all of the trade wastes, the inoffensive as well as the offensive ones, would have to be intercepted and carried to the treatment works, with the result that the treatment works would have to be somewhat larger in size, and hence ould cost more, than would be the case if the separate system had been adopted.

With a community which is largely residential in character, the volume of trade wastes would affect but very little the total sewage flow. With a manufacturing community, however, the trade wastes might amount to quite a large percentage of the total flow and in extreme cases might equal in volume the house sewage. Under such conditions it is evident that, if any considerable percentage of the trade wastes is offensive, separate sewers would be of decided advantages as they would permit of the inoffensive wastes being discharged direct into the storm water drains, the offensive wastes only being discharged into the sanitary sewers and by them carried to the treatment works.

With a combined system, automatic regulators are generally used on the connections between the combined sewers and the intercepting sewer to limit the amount of flow from the combined sewers to the intercepting sewer. With a separate system automatic regulators are not required unless the first wash from the streets is intercepted in the storm water drains. Automatic devices in sewers, as a general proposition, no matter how well designed, are to be avoided whereever possible.

Removal of Grit

The presence of grit at a sewage disposal works is generally more or less of an annoyance, especially when the sewage has to be pumped and passed through settling tanks. With combined sewers, receiving as they do storm water from the streets, a considerable amount of grit must be expected to reach the disposal works, not only during wet weather but during dry weather also. With separate sewers the amount of grit received at the disposal works is relatively small unless the first wash from the streets is intercepted in the storm water drains and carried to the disposal works.

It has been suggested that a considerable amount of grit could be prevented from reaching the disposal works from combined sewers by inserting a catch basin or sand catcher on each connection between the combined sewers and the intercepting sewer. It is probably true that such would be the case but it is a question whether this would be a good method of removing grit. In the first place, these sand catchers would sooner or later fill up and unless cleaned at proper intervals would fail to serve the purpose for which they were built. Again, it is very probable that more or less organic matter would be deposited in them, especially when only the dry weather flow, consisting as it would mainly of sewage, as passing through them. The retention of organic matter would lead to offensive conditions as soon as putrefaction began.

The inserting of sand catchers between storm water drains and an intercepting sewer would seem to be a more practicable proposition, as the possibility of retaining offensive matter from sewage would then be eliminated. The sand catchers would still, however, have to be cleaned in order to make them effective.

With combined sewers or with separate sewers in which the first wash from the streets is intercepted in the storm water drains, grit must be expected. Such being the case, it is a question if the simplest way of handling the grit is not to admit it into the intercepting sewer from the combined sewers or storm water drains, without attempting to intercept any portion of it, and then to transport it with a good velocity in the intercepting sewer direct to the sewage disposal works. Even with sand catchers on the connections between the combined sewers or storm water drains and the intercepting sewer, enough grit is sure to reach the sewage disposal works to require its removal before the sewage is pumped or passed through settling tanks. The removal of grit at one point instead of at numerous points has many advantages.

The common practice of removing grit at a sewage disposal works is to pass the sewage at a slow velocity, roughly about one foot per second, through a grit chamber, the grit settling out and being retained on the bottom of the chamber. In large works mechanical means are provided for removing the grit from the grit chamber but in smaller works it is common practice to drain out the liquid from the grit chamber and then to shovel the grit out by hand.

Grit Chambers

With a separate system, in which the first wash from the streets is not intercepted from the storm water drains, a question arises as to the necessity of providing a grit chamber at the sewage disposal works. Practice varies. At some disposal works grit chambers have been provided and at others not. If the sanitary sewers are properly designed and built and are provided with tight covers, very little grit should get into the systems; but with macadam or dirt streets and perforated covers some grit must be expected. The safest plan, under ordinary conditions, seems to be to provide a grit chamber, even it be a small one. The grit would require removal only at more or less infrequent intervals.

Perhaps the question may arise as to the necessity of removing the grit. It would, of course, be perfectly possible to pump the grit along with the sewage but this would cause unnecessary wear and tear on the pumps. Again, if the grit is not removed before reaching the suction well, it may easily settle in and clog up the suction well, causing thereby a shut-down until the well is cleaned out.

If the grit is admitted to the settling tanks it may cause trouble there. It depends, of course, on what type of tank is used and on the method of operation. If the tank is an Imhoff tank, the grit, by settling down into the sludge digestion chamber, may check or prevent the proper digestion of the sludge and consequently affect the satisfactory operation of the tank. The admission of grit to a septic tank also may interfere with its satisfactory operation. If admitted to a plain settling tank, which is cleaned out at frequent intervals, the main trouble to be expected would be in the cleaning out of the tank.

With sewage from a combined system, the volume of sludge accumulating in settling tanks is greater than with sewage from the separate system. It may even be nearly twice as much, as has been found to be the case by comparison of the quantities of digested sludge removed from different Imhoff tanks, some of which have been connected with combined systems and others with separate systems. The greater volume of sludge from the combined system may mean that less organic matter has reached the streams than would have been the case if the sewers had been built on the separate system. If, however, the first wash from the storm water drains of a separate system is intercepted and carried to the treatment works then the volume of sludge should be approximately the same as if the sewage came from a combined system. Similarly the amount of organic matter reaching the streams should be approximately the same, although it is possible that it might then be somewhat less.

In many instances, probably in the majority of cases, pumping is required in order to pass sewage through a treatment works. This is generally due to the fact that the site of the treatment works is more or less distant from the territory sewered and by the time the sewage has reached the treatment works enough head has been lost to prevent passing the sewage through the works by gravity. It may even be that the sewage would be delivered at an elevation below that of the stream into which the effluent was to be discharged.

With a combined system the total height to which the sewage would have to be pumped would probably be somewhat less than with a separate system, but the difference would not be great. Some saving in fuel might therefore result from the adoption of the combined system but the same operating force would be required in either case. So long as pumping is required the actual saving in cost due to pumping the sewage against a less head, due to the adoption of the combined system, would be slight compared with the total cost of pumping, including fixed charges.

In conclusion, no hard or fast rules can be given for the adoption of either the combined or the separate system. Each has certain advantages. These, as well as local conditions and cost of construction and operation, must be taken into account. Other things being equal, especially as more and more attention is being given to the question of sewage disposal, the separate system seems to offer greater advantages. With either system, however, to secure satisfactory results too much stress cannot be laid on the necessity of not only proper design but satisfactory maintenance and operation.

Report on the Pollution of the Niagara River

IN August, 1912, the International Joint Commission was requested by the Governments of Canada and the United States to determine to what extent, by what causes and in what localities the boundary waters between the two countries have been polluted so as to be injurious to public health, and to propose remedies. Numerous hearings and conferences with sanitary experts have shown that at least five waterways should be investigated, but the Niagara River is the only one that has thus far been studied in detail. A preliminary report of the entire investigation has been made under date of September, 1913, by a committee consisting of Messrs. Frank S. Streeter and Henry A. Powell and issued by the commission. The following notes as to the Niagara situation are taken from the report.

New York Side

Within the State of New York the area draining into Lake Erie and the Niagara River above the falls is estimated at 2,050 sq. miles but the part from which all sewage and surface drainage is discharged directly into the river is somewhat less. The population on this area is estimated at about 615,000, of which somewhat more than 500,000 are in the cities of Lackawanna, Buffalo, Tonawanda, North Tonawanda and Niagara Falls. All the sewage of the cities, except Lackawanna, are discharged in raw state directly into the river, and the sewage of Lackawanna, also untreated, is discharged through Smokes Creek, whose outlet is 1½ miles above the head of the river. All the above cities, with Lockport (which had a population or 17,790 in 1910) and a part, if not all, of the villages near the river bank, take their public water supplies for drinking and domestic uses directly from the river.

Below the falls the waters of the river are uniformly and dangerously polluted from bank to bank and the municipalities on both sides of the river are thereby affected. Above the falls the waters at varying distances from the American bank are polluted by the raw sewage of the above-named cities, and the public water supplies of each of them, when taken from the river without purification, are in varying degrees and at varying times injuriously, if not dangerously, affected by the sewage pollution from the cities further up the river.

The location at Buffalo at the head of the Niagara River, its population (now estimated at more than 460,000) and the fact that all its sewage is untreated and is discharged into the river above the intakes of the public water supplies of all the cities below make Buffalo the most important factor in the problem of the pollution of Niagara River. Of the population within the drainage area of the river in New York, Buffalo has nearly or quite four-fifths. A large increase in the population of this territory in the near future may reasonably be anticipated and, with such increase, the necessity of diminishing the pollution of the river is apparent. What changes can be made is being officially and seriously considered. An expert report, under date of June, 1913, on the availability of Squaw Island as a site for sewage-disposal works for the city has been made. Mr. Rudolph Hering has recently been consulted by the city with reference to its sewage conditions, and his report is expected at an early date. Examination is being made of the recent progress of other cities in methods of sewage disposal.

The committee's examination of the Niagara situation is not completed and no certain conclusions can be reached. One important fact seems to have been conclusively established, however, namely, that the further discharge of raw sewage at Buffalo and other cities into the Niagara River is unwise and that it should be treated to some extent at least before its discharge into the river. The extent of such treatment is still an open question.

Related to this question is another which, from the standpoint of public health, is still more important, namely: What purification of water supplies to safeguard public health should be adopted by the cities taking such supplies from the river below Buffalo? Whatever conclusions may be reached as to the necessary requirements of sewage treatment before discharge into the river, the commissioner's present view is that all cities and municipalities taking their public water supplies from the Niagara River for drinking and domestic purposes should be required to safeguard such supplies by proper methods of purification. This seems to be demanded in any event because of occasional inevitable contamination of the river waters from the surface drainage and washings from the drainage area above described which cannot be collected in any sewer system, but must flow directly into the river.

The committee therefore believes that, to secure a safe water supply from the river for cities on the Niagara frontier, two things are essential—(1) a proper disposal or treatment of the sewage and (2) filtration or other purification treatment of the public water supplies taken from the river.

It is obvious, however, that if the maximum requirement of complete sterilization of sewage of Buffalo and other cities is attempted two serious practical difficulties must be faced: (1) The great and overburdensome expense of installing and maintaining the necessary plant, and (2) the fact that complete sterilization of the sewage would not make the river a safe source of public water supply without purification.

It is hence believed that the inquiry of the commission should now be directed, first, to the extent to which sewage permitted to go into the river should be treated, and second, to the extent of purification required for water supplies taken from the river.

Grouping the Cities

In working out a comprehensive plan by the commission for remedying the pollution of Niagara River another matter, it is pointed out, should be considered. On the American side above the falls are the four cities, Buffalo, Tonawanda, North Tonawanda and Niagara Falls (N.Y.), named in the order of their location on the river. For practical purposes, the city of Lackawanna may also be included in this group, its sewage discharging near the head of the river. It may be assumed that each of these cities is under legal obligation not to pollute the water supplies of its neighbors on the river below. While Buffalo, from the amount of its sewage discharge, is the greatest offender, Lackawanna, the Tonawandas and Niagara Falls each in lesser degree is also delinquent.

Each of these cities will have its individual problem, but any plan to safeguard the public health by requiring artificial purification of sewage discharge into the river, or both, must be made applicable not to some but to all these cities. Because of diverse conditions it may not be reasonable to make the same requirements of each city, either with reference to the extent of the treatment of its sewage or the purification of its water supply. Each city contributes to the common danger, however, and each city should be required to contribute its share to the removal of that danger. To secure an equitable adjustment between the cities of those preventive measures which they must necessarily and concurrently furnish to remedy the common danger, the cases of all the cities contributing to the pollution should be heard and considered together as parts of a single case.

Canadian Side

As to the municipalities on the Canadian shore—namely, Fort Erie, Bridgeburg, Chippewa, Niagara Falls (Ont.), and Queenstown—the water supplies of all these places are taken from and their sewage (untreated) is discharged into the Niagara River, but no examination on the other side has been made except with reference to Niagara-on-the-Lake, at the mouth of the river, where the injurious effects of the pollution from the upper cities on the river have been seriously felt.

The Erie & Ontario Sanitary Canal Company proposes for the consideration of the commission a specific remedy for the pollution of the Niagara River by the construction of a canal starting at the mouth of Smokes Creek in the city of Lackawanna and passing around the city of Buffalo northward through a tunnel 6 miles long to Lockport, and thence over the escarpment into Eighteen-Mile Creek, emptying into Lake Ontario. A full statement of the company's purposes, what it asks for and why are set forth in its application to the Secretary of War, April 23rd, 1912, for the diversion of 6,000 sec.-ft. of water from Lake Erie and Niagara River, for sanitation, navigation, and power. Notwithstanding the provisions of the treaty and the United States statutes relating to the diversion of navigable waters, the canal company desired to submit evidence and statements upon which it might urge the commission to recommend the adoption of its plan, and several hearings for this purpose have been held. The committee believes that these hearings should go forward to determine the feasibility of the company's scheme.

Publicity and Engineering

ONE of the surest ways of securing popular support for bond issues for engineering work is to put the facts clearly before the voters and appeal to their good judgment, says The Engineering Record. Often conditions that must be rectified are so bad that they give all the publicity that is needed. A dangerous or bad-tasting water supply is a sufficient argument for the development of a new source or the construction of a filter plant. Impassable streets do not need to have their shortcomings preached to the populace. In transient matters, however, it may be necessary to institute a publicity campaign to remind the people of dangerous or insanitary conditions, which grow less important in their minds as time passes. This is quite likely to be the case with reference to flood-protection measures. Immediately after the heavy floods of last spring the city of Olean, N.Y., which had suffered considerable damage, retained Mr. George C. Diehl to make a study of conditions and to recommend abatement and protection measures. His report was rendered some time ago. Realizing the danger of apathy, the Chamber of Commerce has taken up the matter and is conducting a vigorous educational campaign by means of circulars and illustrated lectures, all under the direction of a trained publicity man. The reasons for the flood and the methods of abatement are being explained. It is hoped in this way to work up sentiment in favor of the appropriations which will be necessary to carry on the work. The same idea is being applied in a somewhat different way in Dayton, where a demand was found for information as to the progress of the flood-prevention studies. Accordingly a competent man—an engineer with newspaper training—was engaged to put the data in shape for distribution to the newspapers. Doubtless his functions can well be widened when the report is finally rendered, though in a city so badly hit as Dayton was there is less likelihood of apathy than in places where the damage was less. The plan is well worth while for engineers to bear in mind.

A large dry dock was opened at Singapore, Straits Settlements, on August 26th. This dock, known as the King's Dock, is the largest in the Far East. It is situated in Keppel Harbor at Singapore. It has an overall length of 852 ft. with a length of 800 ft. on the blocks and by means of an intermediate caisson it can be divided into two compartments, one 486 ft. and the other 325 ft. in length. At the entrance it has a width of 100 ft. Between the coping stones and the body of the dock there is a distance of 128 ft. while the width of the floor is 90 ft. At low water the depth on the sill is 25 ft. and at high water 34 ft., and the approaches are dredged to a depth of 33 ft. below low water.

Purification of Large Water Supplies by Means of the Ultra-Violet Rays

IT appears that the new method of sterilisation of water by means of the ultra-violet rays has been developed to such a point, and has reached such a stage of practical usefulness, as to make it desirable to describe "the state of the art and principle on, which the modern apparatus is constructed." Mr. Max von Recklinghausen has done so in an article contributed to the Engineering News of New York.

The bactericidal power of the rays is stated to be far greater than is usually credited, the exposure of clear, but infected, water for a small fraction of a second within 1 in. of the source of the ultra-violet rays being sufficient for sterilisation. One of the first principles is the avoidance of any undue cooling of the lamp by the water. The lamp has therefore to be protected. The quartz mercury vapour lamp is used because it is economical, and also because the manufacture of these lamps has been standardized. Generally speaking, the hotter the lamp—i.e., the more energy it absorbs—the higher will be its production of ultra-violet rays. This is limited only by the corrosion of the quartz, which begins to take place at 1,200 deg.

Another of the elementary principles is to allow the maximum amount of light to enter the water. In order that all microbes present in the water may be struck by the rays it is essential that the water should be free not only from large floating bodies, but also from the small visible suspended matter. Thus in many cases the water must be filtered as a preliminary step. "Ordinary sand filters perform this function well, and at a much higher speed than formerly for the production of potable water." Thus we are advised to use ordinary sand filters at from three to ten times the ordinary speed. The size of filters may be considerably reduced where the ultra-violet rays treatment is to follow filtration. In order to ensure that such particles as pass through the filters are exposed to the light on all sides, it becomes necessary as another first principle to bring the water near the light several times, and to create a circulation close to the light by means of baffles.

An apparatus constructed on these principles has been utilised for serving several public water supplies. One installation is mentioned—viz., that at Marommes les Rouen, a suburb of Rouen, France, which installation has been working for nearly three years. Here the water is filtered through sand at the rate of 50 ft. in twenty-four hours, and the ultra-violet rays apparatus sterilises the water at the rate of 100,000 gallons per day by means of a single 1 horse-power lamp. Particulars are also given of a much larger unit. It consists of a sterilising channel, in the walls of which are inserted several lamps. The quartz lamp projects into the water, but is covered with a quartz protecting tube to keep the lamp tube from contact with the water. These lamps each require three amperes at 500 volts direct current. The ultra-violet production of the lamp is ten times as great as for the above-mentioned 1 horse-power lamp. One of these canal units, with twelve 2 horse-power lamps, is sterilising the water supply of a fairly large town. The raw water is obtained from a river, filtered over sand, and then passed through one of these units at the rate of 1,700,000 gallons per day. A large part of the time only a few lamps are in operation, but when the quality of the water demands it all the lamps are used. Thus the degree of treatment can be varied to suit the colour of the water.

Auxiliary Water Supply for Fire Protection

Earthquake-Proof System

IN addition to a high-pressure pipe distribution supply, which includes more than 70 miles of main, an auxiliary water supply system is being installed at San Francisco as a further safeguard. The reason for this is that, owing to the breakdown of the old water supply system, enormous damage occurred after the great earthquake in 1906. It was therefore evident that an earthquake-proof system ought to be provided in view of the fact that the new high-pressure system might conceivably fail at a critical moment in the future.

Reservoirs

Besides two fire boats for the protection of the water front and shipping, a storage system, comprising a series of cisterns specially designed to withstand severe shock, is being constructed. The work is described in a recent number of the Engineering Record of New York. The underground cisterns are intended for use only in case of serious damage to the high-pressure pipe system.

Formerly, when San Francisco had no adequate domestic distribution system, several underground brick cisterns were constructed and used. These, however, fell into disuse, and at the time of the fire most of them were filled with debris instead of water, and their positions were unknown. Since the fire these have been repaired and will be re-used. The new cisterns are made of reinforced concrete, and are eighty-five in number. They are circular in plan, and are built beneath the surface at street crossings, their exact positions being indicated by a distinctive type of pavement over them. Their inside diameter averages 30 ft. The top and bottom are domed, the rise of the top dome being 5 ft., with a 30-ft. span or diameter, the rise of the inverted dome being 3 ft. The maximum inside depth is 18 ft. 1 in., and the average capacity is 75,000 gallons. The walls are 12 in. thick, and the domes are 18 in. thick at the crown and 2 ft. 5 in. at the springing in the case of the roofs, and 18 in. thick at the crown and 2 ft. thick at the springing in the case of the floors. No fixed pipes for filling and emptying are rigidly connected to the cisterns, thus eliminating, should an earthquake occur, the disrupting stress excited by a rigid connection upon the concrete structure, which should thus vibrate as a whole without injury. During the construction of one of these cisterns a rain storm occurred which caused the tank to float, and to rise 6 ft. above its foundation. After the water had been drained away the cistern was found to be perfectly sound. This is taken as a satisfactory proof of the trustworthiness of the cisterns for the purpose for which they are designed.

Pipes

"The same precautions which was taken in designing the cisterns to provide for resistance to vibration was exercised in designing the high-pressure distribution system." Cast-iron pipe has been used throughout, and is considered to be best for the purpose. In the chert formations, and in the solid sand clay formations, it was found that the oscillation in the earthquake was not nearly so pronounced as in the filled-in area, which constitutes a considerable part of the lower districts. Thus, a different type of joint was considered desirable in each of these two classes of ground. For solid ground a spigot and socket leaded joint was chosen, while for the filled-in area a double spigot sleeve joint with steel sleeves was used. This double-socket joint is capable of withstanding, without excessive leakage or injury, twice the amount of lateral distortion that the spigot and socket joint can undergo. The standard joint for each case was decided upon after an elaborate series of tests had been made. The socket is of great strength, and there are double ring grooves to hold the lead in the interior of the socket; otherwise there does not appear to be any great difference between these and the ordinary socket joint. Where it was necessary to lay pipes with sockets pointing downhill, lead wool was used. In testing these mains the joints were left exposed, and if the leakage amounted to more than .0055 gallons per lineal foot of "pipe joint" in twenty minutes, while water was being pumped in by a force pump, the joints had to be recaulked. The mains used for a head of from 600 ft. to 760 ft. were subjected to a test pressure of 450 lb. per square inch; this test pressure was lessened according to the working head on the main, the lowest test pressure being 150 lb. per square inch.

Recent Progress in Methods and Character of Street Cleaning

By S. Whinery, Consulting Engineer, New York

THERE has been no radical or particularly noteable advancement during the last few years in the machinery and methods of street cleaning in American cities. But no little progress has been made in improvements upon methods and appliances that have become standard, and their more efficient and economical use, in complying with the public demand for cleaner streets than had heretofore been tolerated, and in a more careful study and analysis of the business, especially with reference to detailed cost of the work, for the purpose of effecting economies.

Machinery and Appliances

The flood of patents issued for street cleaning devices continues unabated, but these patents relate largely to details and disclose little of value for practical use. This is somewhat surprising in this land of inventors. Most of our street cleaning apparatus is admitted to be more or less crude and unsatisfactory, and there would seem to be possibilities for material improvements, if not radical innovations. The applications of mechanical power in the place of horsepower to street cleaning work has received attention and has been tried in a number of cities, but the results do not seem to have sufficiently commended themselves to municipal officials to warrant their more general use at present.

The application of the vacuum or suction principle to the picking-up and collection of street dirt is also being experimented with to a small extent. Such machines, if they can be perfected so as to do the work satisfactorily and economically, would have the great advantage of removing the dust from the street without resort to the use of large quantities of water, which is a consideration of importance where water is scarce or high in cost.

Thoroughness and Efficiency

There has been in the past few years a decided advance in the standards of cleanliness of streets demanded by the public and attained by the municipal authorities. This is noticeable both in the large and in the smaller cities of the country.

In towns and the smaller cities, and the suburban section of the larger cities, where earth and broken-stone street surfaces prevail, the use of oil to suppress dust has greatly increased, and is now quite general. While this is not, strictly speaking, a street-cleaning process, it serves as an effective improvement in the comfort of using such streets, and eliminates the sanitary danger, and the inconvenience and damage from flying dust.

Accounting and Analysis of Cost

Perhaps the most promising and fruitful advance that has been made in recent years is the greater attention given to the study of the details of street cleaning and the keeping and analysis of more complete and itemized accounts. In an increasing number of cities the accounts of the street-cleaning department have been revolutionized and expanded so that the total and unit cost of every important detail of the work may be ascertained and analyzed. This requires, of course, greater attention to the collection of exact data of quantities and costs, and involves no little additional expense, but it is becoming more and more appreciated that the money so spent is wisely invested, since the main reliance for increased efficiency and economy in this, as in most other lines of business, must be upon small savings in many details rather than upon any radical changes in methods and machinery.

The value of the results of practice and experience in other cities for comparative study is becoming more appreciated, and there is, therefore, growing up a strong demand for the general adoption of a uniform system of accounting, and for more complete and detailed printed reports of street-cleaning departments.

Some of the important matters that have more recently, and are now receiving increased attention may be mentioned:

One considerable source of the dirt and waste that must be removed from the streets is commonly called street litter, consisting of miscellaneous wastes thrown upon the streets and sidewalks by those passing along the streets, or swept out of business houses and residences. Street littering is effectively prevented in most European cities by the rigorous enforcement of laws or ordinances prohibiting it. Most of our American cities have such laws and ordinances, but they are practically "dead letters."

The possible utilization of street sweepings in some way that will partly repay the cost of street cleaning is another matter that is receiving more attention than heretofore. The most promising outlook for such utilization lies in the direction of filling low lands, or building up new and very valuable areas of land by filling in shore areas now covered by shallow water and at present not useful for any purpose. Contrary to the prevailing opinion, experience and investigation have shown that street cleanings free from garbage may, if properly handled in the dumps, be so used without danger to the public health and without serious inconvenience or offense to the public.

Street sweepings from paved streets contain very considerable quantities of valuable fertilizing elements, the value of which at the market prices of these elements, probably averages at least two dollars ($2) per ton of sweepings. The cost of transporting and handling the raw sweepings is usually too great to permit of their profitable use as fertilizers in the farming districts, but some satisfactory method ought to be and probably will some time be discovered to profitably recover these fertilizing elements.

Attention is being urged in many cities toward preventing the large accumulation of dirt and debris, and the inconvenience and expense of street-cleaning department, caused by building operations. Custom seems to have given builders the idea that they have a right to deposit the waste from their operations upon the fronting streets and that it is the duty of the street-cleaning department to remove and care for it. A number of cities have taken suitable action in this matter and others will doubtless follow.

Demolition of a Tunnel

The demolition of a tunnel which hitherto has prevented the widening of the Great Central Railway Company's main line from London to Sheffield has just been completed at Darnall, an east-end suburb of Sheffield. The removal of the tunnel, which was 300 yards long, has occupied seven months, and the work of providing two extra permanent tracks for a distance of three miles will now be undertaken. According to The Times Engineering Supplement, the demolition of the tunnel has proved very difficult, owing to the fact that on account of a number of trains passing—averaging 330 in twenty-four hours—the blowing up and clearing away of the masonry has had to be confined to the period between 11.25 on Saturday nights and 1.40 on Sunday mornings. The work has been completed without delaying a single train and without an accident. The greatest length removed at one time was 118 ft., necessitating the removal of between 500 and 600 tons of debris. Altogether upwards of 600,000 tons of material have been removed, and the cutting thus left is 85 ft. deep from the top to the rails. A 15-ton derrick on bogies, with a crane having a dip of 82 ft., was employed, and also a giant steam navvy capable of removing 1,500 cubic yards—nearly 3,000 tons—in ten hours.

Municipal versus Contract Street Cleaning

By J. W. Paxton, Superintendent of Street Cleaning, Washington, D.C.

STREET cleaning by city labor in Washington, D.C., superseded the contract system on July 1st, 1911. Notwithstanding the changes in methods and the first cost of new equipment, the expenses for the first year were lower than those for the years when the work was done by contract. At the end of the second year, June 30th, 1913, the records disclosed that for the expenditure of the same amount of money more than 25 per cent. more work was accomplished than during the last year of the contract system.

Under the contract system in Washington changes in specifications and methods of doing the work took place very slowly, and usually only when specifications were made up for new contracts, which was once in five years; but in the municipal work of the last two years improvements have been of daily occurrence. Each blockmen's work has been studied individually. Time studies with odometers have been made of all vehicular movement. Collections are all made working toward the dumps. Schedules are arranged for all machines, squeegees, flushers, etc., so as to do effective work every moment from the time they leave the stable until their return. Each gang is arranged with the view of having the number of sprinklers, machines, broomers, shovellers and carts in proper proportion. It has been found that some of the wider alleys can be swept to advantage with one-horse brooms, and schedules have been very carefully worked out to do the work with as little loss of time as possible in going from one alley to another.

The area of each square, intersection and alley has been carefully computed and card-indexed, and a cost-keeping system has been established which assists in comparing the cost of cleaning 1,000 sq. yds. each month or oftener with the cost in previous months, or one foreman's work with that of another doing similar work, or one method of cleaning with another. The office is supplied with a multigraph printing machine, so that schedules may be changed and reprinted on a day's notice.

The most radical change in methods has been to increase the hand-cleaning combined with an occasional washing and to decrease the machine-broom areas. The machine brooms raise so much dust that heavy sprinkling is required; the fine dust mixes with the water to form a fine mud, which is smeared on the street by the broom, and, becoming dry, turns to dust again. The brooms only sweep the coarser particles, and many of these are thrown by centrifugal force over the broom back to the pavement.

Hand-cleaning work is capable of better distribution than any other method, more attention being given to the dirtier areas by simply increasing the number of men, who only clean the portions of the street which are dirty and work on these portions until they are clean. There is a fine scum which becomes plastered to the pavements, particularly sheet asphalt, which is not apparent when the pavements are dry but rises up in a thin sheet of mud when moist, making the pavements very slippery. This and fine dust cannot be removed by the hand cleaners; but by washing about twice per week, in addition to hand cleaning, these troubles can be eliminated.

Time Studies and Increased Efficiency

Establishing Tasks and Inducing Workmen to Accomplish Them—A Particular Method from Which General Principles may be Derived

By Ralph W. Langley

THE purpose of these informal notes is to give an account of some difficulties met in establishing tasks and inducing operators to accomplish them. It is not assumed that the methods of meeting these difficulties would succeed equally well in all industries. However, they have been found to be at least partially successful in the particular industry to which they have been applied; namely, the manufacture of coils for electrical purposes.

The Collection of Data

The first step taken in establishing tasks was to collect data by means of time studies. Before the results of these time studies were filed as permanent records, however, every effort was made to supply the operator with the best facilities for doing the work. In fact, several days were largely taken up in recording conditions which needed improvement. This part of the work has continued to call for attention even after it appeared that every possible improvement had been made, and a list of things to be done is kept and checked off as accomplished.

The various departments were taken up separately, an important operation was chosen in each, and the operator who was said to be the most skillful was studied first. Various operators were chosen at random, studied in the same kind of work, and the time taken by each operator for a given element was compared with that taken by the others. The results were often surprising, for the operator who was considered the most efficient by the foreman was often found to be inferior to one with no apparent claim to merit.

Best Operators for Time Study

The choice of operators to be timed was limited to those who were proficient in the kind of work to be studied; of these, the operator was chosen who most often repeated the various elements in the same order. The objects of the time study were explained to the operator as clearly as possible in the beginning and especial emphasis was laid on the statement that a piece-work rate was not contemplated. It was noticed that when an operator starts, even on work to which he is accustomed, the time taken at first is longer than after the first six or eight pieces have been completed; as the operator becomes fatigued, the time taken to pick up small objects is the first to become longer. If the work was such that several sequences of the various elements could be used, the operator was induced to try them all in order that the one shown to be the shortest might be selected and studied. After some experience it was possible to tell off-hand, in most cases, whether the usual method was the best.

The Attainment of Accuracy

For accuracy, reliance was placed on a large number of observations made at various hours of the day on one operator. When the same operation had been observed 30 or 40 times the elementary times were selected and the minima chosen. These elements were found valuable in starting new work to determine whether or not the operator was trying to mislead the observer.

More concordant results were obtained by using a "running watch" whenever possible, that is, to start the watch and read it at intervals during the operation, and to start again when the operation is repeated. Elements as small as could accurately be recorded while the watch was running were chosen, but it was found much more important to choose an element with a sharply defined ending than to take one shorter and less well defined. The individual time for each of a series of elements chosen primarily, because they are sharply defined, will invariably be more concordant and accurate than if the operation had been separated into the shortest possible elements without regard for clearness. That time which occurred most often was selected as the so-called minimum.

If it was necessary to find the time taken for an element too short to be determined with a running watch, it was obtained independently on another series of operations. The elements were recorded as fast as they were accurately determined and while still fresh in the memory of the observer. It was found best to tabulate them primarily according to the operation, and, secondly, according to the type of coil.

Fatigue Allowances

Another difficulty is to determine the fatigue allowance. If the time allowed for a task was the sum of the minimum times for all the elements involved, only the most expert operators would accomplish the task, and only when no unavoidable difficulties arose. In order to enable the expert operator to accomplish the task consistently and the less experienced operator to accomplish it at all, a certain additional time must be allowed. This is a more or less arbitrary percentage of the sum of the elements called the fatigue allowance.

The necessary fatigue allowance for any class of work was determined by making detailed time studies of the less expert operators at various hours of the day. Any avoidable delays were deducted and the difference between the actual time consumed in completing an operation and the theoretical time calculated from the elements was called the fatigue allowance in the task as set for an average operator it was assumed that increased skill due to practice would in a measure offset physical fatigue.

The Advantage of Definite Sequences

A strict sequence of elements for a given operation seems to be of great advantage to the operator. This becomes irksome to some who vary the monotony by using various sequences, but this is never done by the most successful. In fact, a uniform sequence of moves is a good criterion of the operator's skill.

Having collected enough data to make a start, the most skillful operator was assigned to a task. Fortunately, Mr. H. K. Hathaway pointed out the importance of encouraging the operator and directed that each piece be timed at first until the operator gained confidence. The task was accomplished, and other less skillful operators became interested and increased their output even before being assigned a task, apparently to see what they could accomplish. Inexperienced operators on bonus began to exceed the former output of the most skillful.

At first the task seems so difficult in comparison with what is tacitly considered a fair day's work that it is hard to induce anyone to consider it seriously. If one operator can be induced to accomplish it others will follow, but unless especial attention is given to this in the beginning it soon becomes a tradition that the task is impossible because no one ever did it—because no one ever tried.

On the other hand, a group of earnest operators will soon gain confidence in the fairness of the time allowed on new jobs and will attempt the task without question.

In the coil-assembling department the variety of work done by each operator was great when the system was first established. The principle was that any operator should be able to do all kinds of work equally well. Absolutely no tasks worth mentioning were accomplished until this theory was abandoned. The operators were separated into zones with an instructor for each zone. As far as possible each zone specialized in one kind of work. An increase in the number of tasks accomplished followed at once. This was increased as soon as an instructor earned a bonus.

Difficulties of Task Work

The most serious difficulties in the way of accomplishing every task are as follows, assuming that the time allowed is correct:

1. Selection of earnest operators.
2. Selection of suitable instructors.
3. Operators' lack of confidence with new work, fear that time will be cut, and lack of initiative to try to accomplish a new task; cliques among the operators to obtain more time for a job by failure to accomplish it.
4. Routing of work to operator least fitted to do it.
5. Preparation of instructions that will be detailed, concise, and impossible to misconstrue; and the inducing of operators to follow them carefully.

As regards the selection of operators a process of elimination has been followed. The choice of instructors is limited to the operators. Both of the conditions need attention. Lack of confidence and initiative, as well as cliques among the operators, should be followed up and reported by the instructor to the time-study man. It is hard to induce the instructor to keep the time-study man posted on prospective failures to earn bonus, and many tasks are lost because the operator does not know whether or not he is falling behind. The most successful instructors are those who keep close watch on the output of each operator until he gains confidence. Instructors who can use a watch are of great assistance. Often operators will refuse to attempt the task, and when it is demonstrated will say that they can do one or two pieces in the time allowed but not the batch. When the observer is positive that the operator is deliberately trying to mislead him and that he is perfactly able to accomplish the task, he informs the operator that he can accomplish the task or leave. In some cases the operator will proceed to work and finish in 70 per cent. of the time allowed. It would seem that a book of shop rules to be given each operator, outlining clearly the policy of the management as well as the rules of the shop, would help to solve this problem, and eliminate many misconceptions.

If it is possible to assign work to the operator best suited to it, the chances are naturally more in favor of success. A tag with each operator's name and, as far as possible, a list of work on which he is most expert, is kept on the bulletin board to help in this respect. This tag moves to the hooks together with the job ticket on which the operator is at work.

Instructions that are both complete and concise as well as detailed are difficult to prepare; some quality must suffer as the others improve. It proved necessary to sacrifice detail, at least temporarily, because of continuous changes in the specifications and rush on new work.

Minutely detailed instructions were found invaluable in training new operators when the instructors would use them as follows:

The instructor gives the instruction card to the operator and tells him to read, as the instructor demonstrates slowly and names the various objects as they are handled. This method accomplishes several things; it fixes the names in the operator's mind, insures a definite sequence of moves, prevents mistakes, and at the same time it increases the instructor's efficiency. If the operator forgets how to start a thirty-minute operation after the instructor has finished it, he is more apt to consult the card than appear stupid by calling back the instructor.

In short, it was found that the duty of the time-study man had only begun when he had accurately set the task. Unless he makes it a point to visit each department and see each instructor, daily if possible, a great many details which are vital to success will be ignored, and unless he makes every effort to exercise tact he may only succeed in defeating his own purposes. The utmost conservatism in his views as expressed regarding the tasks is essential, up to the point where he is able to satisfy himself that the task is a fair one. This offers an excellent opportunity to exercise his powers of patience as well as observation; and he is constantly reminded by circumstances that it is just as easy to be mistaken as it is necessary to be right.

It has been our experience that much trouble can be caused by setting a task on new work, and using elements selected from similar work, if there is any doubt that the two jobs are exactly alike. If the operator fails to earn the bonus he will usually take twice the time allowed even if he could finish in a little more than the allotted time. This is possibly due to a feeling of resentment. It is not unusual to find that a liberal time allowance on bonus will double an operator's output over that accomplished on day work. If the time allowed is so short that only the one expert can finish in time, the three other operators of average skill will consume twice the time allowed. It would seem that the greatest good for the employer and the greatest number of employees demands a liberal time allowance with a fair bonus rate rather than an extremely close time allowance and high bonus rate.

Surface finish for concrete was given attention by the Board of Water Supply of the City of New York in connection with bridge construction on the Catskill aqueduct, and of several methods examined for securing even, clean textures the use of selected aggregate of pink granite for mortar facing was successful in special cases, according to the board's annual report for 1911. The mixture was poured by the aid of a sheet-iron diaphragm, moved as the backing was poured, the facing and backing being thus placed as a monolith. Experiments showed that the most practical ways of treating concrete surfaces were by pneumatic hammers and by sand blasts.

The Analogy Between Horse-Racing and Estimating

By G. Alexander Wright

MAY it not truly be said that there is very little difference between horse racing and bidding on buildings? Are they not "gambles?" The invitation to figure and the jockey's start are similar; both events arouse a like interest; both hope to win. The odds are long, for there are many entries. There is the usual horse racing talk about the "dark horse," the "favorite," the "pull," the "inside track," and so forth, none of which is probably ever true, in either case; but it is horseracing talk.

At last the start is made, and away they go! The bidders and the ponies over the same ground, the same course, and the owners look on and speculate. The primary object is to get ahead of each other, win at any cost, and each competitor does his best to beat the other fellow. If the first jockey in has forgotten or omitted anything, he is disqualified. If the bidder forgets or omits anything, he "gets the contract." It amounts to about the same thing, and the bidder is quite as much of a real sport, for he takes "his medicine today and gambles again tomorrow." But this is not what I started out to say. If, perchance, it has had the effect of seriously arresting the reader's attention to a most important subject, some good purpose may yet be served.

And now to be serious: Speaking of estimating in competition, an experienced and well respected western contractor recently described our present estimating methods to me as "a horse racers' gamble." Few architects, if they will look squarely at the facts, can honestly differ with the candid western contractor. Owners, and persons not over kindly disposed toward architects, claim that we know but little about the "cost" of a building; but these same people do not themselves know anything of the mysterious and devious processes involved in the obtaining of a bid, which, unfortunately, they too often think is to be the "cost" of the building. Architects, however, know of these things, and that the word "estimate" or "bid" does not really mean the "cost," when the work is finally completed. Architects, however, seldom deem it their duty to enlighten clients upon such matters, and this is especially so in the case of the architect who, by whatever means he may choose to employ, is able to persuade owners into believing that he can give them cheaper and quicker results than some other architect having offices round the corner.

Architects to Blame

It is not an unusual circumstance for a contractor to sign up for a job, when even the best of us are morally certain that the work as shown and specified, can never be properly done for the money. But we as architects are paid to see that it is so done, are we not? Why then should we allow an owner, or ourselves, to accept such a bid, and so to place this burden upon any contractor, who, for want of a systematic method, underestimates his quantities, or, as too often happens, omits something entirely? Some owners (happily not all) are looking for these mistakes, and are ready to seize the advantage, usually in the mistaken idea that they are to get something for nothing. Some architects will be perfectly content with the thought (more is the pity!) that it is none of their business; that it is up to the contractor to look out for himself.

It is well known that under our uncertain system of estimating, by which the contractor is made to take all the chances, these things do and must occur; that they are winked at, and that they cause much unnecessary trouble. But is this good practice, or sharp practice? Surely our ethics should extend beyond the mere personal equation; so, to put it plainly, is it "honest?"

Is it just, when we, in a sense, undertake to act as architects and arbiters of the contract? If not, can we wonder at the thousand and one questions, difficulties and extras which occur in the supervision of such a contract, under the present system? Can we wonder that contractors are sometimes suspicious?

But, not to dwell too long on this picture, let us seek a practical remedy for removing these and other similar conditions which make such a picture possible. The individual architect or owner, let it be said, is not solely responsible. The entire trouble lies in our senseless, wasteful, unscientific, and wholly faulty methods of inviting bids, and in the encouragement to gambling which we, who should be the first to condemn, still extend to bidders. That the contractors do not rise up and smite us, is really a source of wonder to me. Not our business, indeed! It is our business to encourage better and more honorable methods.

The scope and character of our construction has advanced so rapidly and considerably of recent years, that scarcely anything is done now as it was even twenty years ago; and the time now allowed to a contractor for estimating is altogether too short; conditions are not conducive to accurate results. Without accurate quantities, there can be no accurate bids, and with our rough-and-ready guess-work methods, wide differences in bids must necessarily prevail. The lowest bid is usually by no means the most accurate, and frequently it is out of all proportion to the quantity and character of the work under contract. Before the work proceeds very far, the mistake is discovered; then there arises the natural desire of the contractor to save on his contract.

But the difficulties, and sometimes friction, which we meet with upon our buildings in progress are not usually caused by the effort of the lowest bidder (sometimes spoken of by the daily press as the "fortunate" contractor) to make a larger profit than that to which he is entitled; the difficulties are quite as often due to his not unnatural wish to keep his loss on the contract within the smallest possible limit.

Therefore, is it not indisputable that incorrect quantities are in the first place largely responsible for unnecessarily low, and consequently inaccurate bids, which, in their turn, cause so many of the architect's troubles?

Another factor is the too short time allowed to bidders for estimating, while a third and very important factor is found in the fact that our modern methods of construction require special training in order to take off quantities accurately. Few contractors possess these advantages, and even if they did, fewer still could find time to put the principles of scientific quantity-taking into profitable effect.

The ridiculous—even the ludicrous—side to our present way lies in the fact that when contractors are invited to submit a bid in dollars and cents in competition, off they go (like the race horses) to compete against each other, neck and neck, as to the quantity of material the job will take; and the more careful a bidder is in taking off his materials accurately, the less chance he has, under present methods, of getting the job!

The whole business seems absurd to any one with any pretense to experience in quantity taking. There can only be a certain amount or quantity of material necessary, and no amount of figuring can make it less; it is folly, therefore, to think that a number of bidders on a piece of work will all succeed in taking off just the right quantity; one person might, but not a dozen or more.

If some system could be adopted whereby each bidder would be furnished with a complete, detailed list of the exact quantities of materials and labor required (thus placing all bidders on the same basis), then the competent, careful contractor would get more contracts at proper prices, and so be able to do better work, while the incompetent and the shoe-string bidders would either have to become more competent or seek other fields of industry, a result which would prove quite as much of an advantage to architects as it would to the remaining contractors.

It is obvious that some such system must in time displace our present wasteful and primitive method, if for no other reason than for the benefit such a system would confer upon both architect and client. It would seem that much good would result if the chapters throughout the country gave some consideration to this vital subject and familiarized their members with the advantages that would follow the adoption of some standardized method or system of estimating upon quantities. This and other kindred subjects have recently been receiving consideration in certain chapters, while many architects and contractors in different States are well known to favor the adoption of an estimating system, based upon accurate bills of quantities, which shall become the true basis of the contract. This will certainly be done some day, and then we shall all wonder why so much time, effort and money have been thrown away in the past.

Concerning Water in Concrete Mixtures

THE occasional failure of important concrete structures, when subjected to floods or other unexpected conditions, indicates that low cost and profits are given more consideration than strength and durability. Then, again, from the writer's observations of the work of others, he is led to believe that while a careful study has been made of cement, sand, and aggregate, the function, purpose, and effect of water in the mix is little understood.

Cement, sand, and the coarser aggregates are inert solids without cohesive or adhesive power. Water, on the other hand, is a fluid without adhesive or sticking power to join two substances together. But water has a very strong surface tension. This is exhibited in what is known as capillary attraction. It is water that binds the inert materials together. This binding power is greatest when every particle of cement, sand, and aggregate is covered with a continuous film of water. If too little water is present, or if it is not evenly distributed, the water film will be broken. If, on the other hand, the thickness of the film is increased to the filling of the interstices between the aggregate this binding power decreases until it is nothing when the solid particles of the mix become immersed in the water.

In addition to being a binder of the solid elements of the mix, the water acts as a lubricant, allowing the solid particles to slip on one another and assume positions resulting in smaller interstices. This increases the density of the mass, and also the capillary attraction of the water film, provided there is not sufficient water present to destroy this film tension. When the excess of water destroys film tension the solids become separated or "suspended" in the fluid. The finer particles of cement "float" in the water filling the interstices or settle from the mass on agitation, and at the same time the "lubrication" of the larger particles is not increased.

It is the finer particles of the cement that develop the greater strength, but when suspended in the fluid or separated from the mass, the "hands" of these particles are not sufficiently long to bridge the water gap separating them from one another or from the larger solids.

It is far easier to build up the water film by careful addition of water than it is to distribute the water after it has been added. If excess of water is added to one part of the mix, so as to "float" the fine particles of cement, it is a question if the film tension can be restored by mixing this with drier materials. This kind of concrete may appear all right, but one part of the mass will not be sufficiently lubricated so the solids can assume the positions for greatest density, and the other parts will be over wet so that the particles of solids will be separated by excess water, and film tension will be lacking in either case. When water is poured or flows from a pipe or nozzle, this is sure to be the effect. The less nearly the cement fills the interstices of the aggregate the more pronounced the effect will be from improper watering. When the water is in just the right proportion to furnish the lubricating effect and the greatest binding power, these forces tend of themselves to draw the particles together into the dense mass.

The third property of water in concrete is to furnish the element that causes crystallization of the cement, giving to the concrete its strength. The observation of the writer leads to the belief that the crystal takes the best form when the water is present as just described. But this will not give sufficient water for the complete growth of the crystal. More water must be fed it during the time of curing in order to grow it to maturity.

The writer has used much bank gravel in concrete construction. He has found it economy to screen the fine from the coarse aggregate. Mix the fine aggregate and the cement, and then mix this with the coarse aggregate, thoroughly drenched. Following thorough mixing, water as needed, is added by sprinkling until tempered to the proper consistency. The sand, fine aggregate, should be just sufficiently damp to cause the cement to adhere. This dampens the cement and establishes capillary attraction. The coarse aggregate has but little capillary attraction and, on mixing, its excess of water is taken up by the superior attraction of the finer materials. In this way the material is all bound together.

With proper watering and curing the same strength is developed with one-half the cement as with improper watering. And when the work is properly managed the cost is very slightly increased. This is true of either hand or power mixing. It is simply a question of whether it is best to add brains or additional cement to the mix.—Municipal Engineering.

G. T. P. Station at Regina

Architects: Messrs. Ross & Macdonald

PLANS have been prepared by Messrs. Ross & Macdonald, architects, of Montreal, Toronto and Winnipeg, for the Grand Trunk Pacific Railway station at Regina. The building, which will occupy an area of about eight thousand square feet, is to be erected at the corner of Albert and Sixteenth Streets. It will be two storeys in height, the lower part being reserved exclusively for the service of the travelling public and the upper part divided into offices for the railway officials. The main waiting room, however, will extend through the two storeys of the building.

The station will be constructed of buff brick and limestone trimmings throughout, with large windows and wide entrances. On the front and the Sixteenth Street side there will be huge canopies of iron and glass, extending out over the entrance steps and the sidewalks. The front will be surmounted by an ornamental clock.

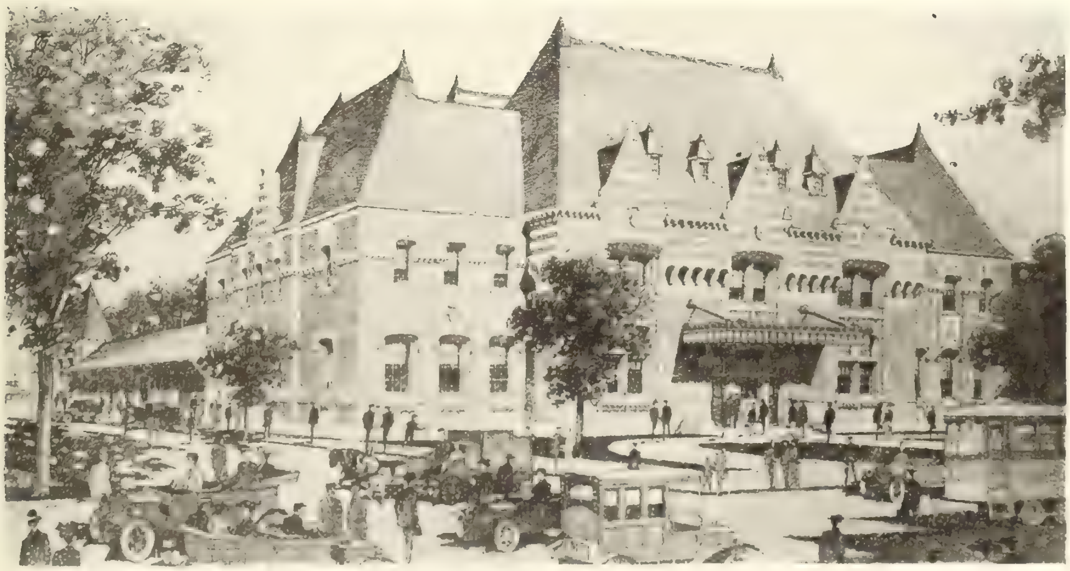
The front entrance will lead into a vestibule, with walls and floor of marble and ceiling of ornamental plaster work. From the vestibule there is direct communication with the main waiting room, the walls of which will be entirely of Caen Stone, the floor of different colored marbles, and the ceiling of decorated plaster. Around the room there is to be a gallery, with a handsome bronze rail in front, from which will open the various offices in the second storey.

On the right of the main waiting room, entering from the street, a commodious restaurant and ladies' waiting and retiring room will be situated, while on the left will be placed the men's waiting room, main stair to the offices above, elevators, shoe shine parlor and second-class waiting room. Directly ahead on either side of the main waiting room the ticket and parcel offices will be located, and at the end the exit to the train platforms. On each side of the main entrance vestibule two alcoves will be provided. The one to the left will contain the news and cigar stand, and that on the right will contain three telephone booths. Outside the station proper and opening directly off the concourse the baggage room will be built, this being conveniently situated for both outgoing and incoming baggage.

Pipe Break at Lockport

A serious pipe break occurred in the 30-in. steel lock-bar force main at the crossing under the International Railway Company's tracks in Lockport, N.Y. Workmen for the railway company were excavating holes for trolley poles, and the rupture in the pipe, according to information received from City Engineer Julius F. Frehsee, was the result of a concussion caused by blasting the rock close to the pipe line. The rent in the pipe was about 5 ft. long and the sheets of steel were forced inward about 11 in. The lock-bar was broken completely in two in several places. The centre of the rupture was located 5 ft. east of a butt strap. The blast caused the steel sheets in this 30 ft. section of pipe to separate, or pull out of the lock-bar practically the entire length of the pipe. It was necessary to remove two 30-ft. sections of lock-bar pipe which were replaced by five 12-ft. lengths of 30-in. cast-iron pipe.

A 40-ton girder 8 ft. deep and 63 ft. long was hoisted 255 ft. above a street in New York and set over an occupied building in twelve minutes by Milliken Brothers, Inc.



Proposed G.T.P. Station at Regina

The Normal School, Regina, which has been erected at a cost of $250,000. Architects, Messrs Storey & Van Egmond; contractors, The Parsons Construction Company.

Constructional Operations Proceeding Apace at Regina

Correspondence of the Contract Record.

ALTHOUGH building conditions have been affected by the financial stringency, present conditions are much better, and the prospects of a large crop have given business a brighter tone.

A number of important projects are under consideration. The most important of these is the City Council's schedule for local improvements, which involve an expenditure of nearly $800,000. The Federal Government has purchased a site upon which a Customs House will be erected at a cost of $200,000. The structural details will be announced later.

We reproduce herewith views of the Connaught and Normal schools, now nearing completion. The Connaught school was erected for the Public School Board according to designs prepared by Mr. J. P. Puntin, architect. Messrs. Cotter Bros. were the general contractors.

The Normal school, which is costing $250,000, was erected for the Provincial Government by the Parsons Construction Company, Regina, according to plans prepared by Messrs. Storey & Van Egmond, Regina. The Normal school is three-storeys high and is of red pressed brick construction. It is faced with Bedford stone.

Plans are now being prepared for an up-to-date apartment block on Victoria Avenue for Mr. W. M. Williamson.

City Engineer McArthur has decided on a novel plan to keep the roadways of Regina in proper condition. The assistance of the boy scouts has been enrolled. Boy scouts patrol different sections of the city at stated times, and report where improvement is needed in the roads. These reports are handed over to what is now called the "road repair gang." This gang of men is employed for the specific purposes of making repairs, and is kept busily engaged on fixing all the bad spots reported on by the scouts. It is expected that by this system the roads throughout the entire city will be in good repair by freeze-up.

The sewer work contracted for by the Regina city council early in the year is nearly all completed, and already the city engineer and his staff are busily engaged on planning the extensions for next year.

Building Regulations at Victoria, B. C.

In the building by-law amendment which is to be considered shortly at Victoria, B.C., provision is made for the limitation of buildings to 100 feet, except those of steel frame construction.

A limit of 100 feet from street grade to top of coping is

The Connaught School, Regina. The Saskatchewan capital's latest and most creditable type of school building. Architect, Mr. J. P. Puntin; contractors, Messrs. Cotter Brothers.

imposed for all buildings except of this character, the maximum of any kind being 130 feet.

Most of the provisions deal with constructional improvements which have developed in the experience of the last 15 months since the present by-law was approved. Most concern the actual construction of buildings, while others are of general importance.

Stairways in class B buildings, not more than three storeys in height, not including basement, may be built of wood; provided that this sub-section shall not apply to buildings used wholly or in part for hotels, apartment houses, lodging and rooming houses, public halls, theatres, dance and concert halls.

No signs are to be erected on roofs within the fire limits Nos. 1 and 2 without permission from the council. The regulation with regard to removal of wooden buildings being taken away for new structures is made much more stringent in view of certain experiences which arose last year and caused the council a great deal of trouble.

Further regulations with regard to repairs are established, and the important provision is made that during the construction of any building of more than three storeys in height, the joists, beams or girders on each floor below the level where work is being done are to be adequately covered with scaffold planks laid closely together to prevent workmen from falling between the joists and girders, and protect them from falling material. Guard rails not less than three and a half feet in height are to be placed on all swinging, suspended, or outside scaffolds, and around elevator, stair or other openings in the interior of such buildings.

It is probable that several bodies of citizens interested in constructional work will desire to express their opinion before the amendments are finally ready for adoption.

Mainly Constructional

The News in Brief—From Coast to Coast

Good progress is being made on the new civic abattoir at Toronto and it is hoped that it will be in operation early next spring.

Building permits for the first nine months of the year in Winnipeg amounted to just over $16,000,000, as compared with $18,407,450 for the same period of 1912.

Vancouver's building permits for September totalled $1,318,796 and for the first nine months of 1913 $9,752,738, as compared with $1,570,395 and $12,722,997 for 1912.

The Montreal Board of Control have decided to experiment with wooden blocks, creosoted, for paving. Some years ago tests were made, but the report was unfavorable.

The Alberta Home Builders' Company is building seventeen new houses at Ogden. Work is expected to start almost immediately, and a suitable location has been selected on the flats.

The Montreal Chambre de Commerce has suggested the appointment of additional building inspectors as a means of reducing the number of fires, which have recently increased considerably.

During the period, January 1st to September 30th of this year, 5,594 permits were issued representing a total expenditure of $22,410,289. The corresponding figures for last year were 5,592 and $22,240,383.

A two-hundred-brick per day unit of the Mount Royal Brick Company is being completed at Vearennes, Que. The construction work is now finished, and the installing of the machinery will commence very shortly.

Price Albert building returns for the nine months period just closed are $1,328,990. This compares with $1,859,425 for the corresponding period of last year. Mr. H. L. Fitzsimmons is building inspector for Prince Albert.

There is now only one more of the big spans across the St. Lawrence, in connection with the Lachine bridge to be put in place. The double track across the bridge itself is expected to be ready at the end of the month.

An order for 50,000 barrels of cement has been placed with the Edmonton Portland Cement Company by the Government of Saskatchewan for use in building the provincial university buildings to be erected at Saskatoon.

A company is now being formed in Aylmer, Ont., which will ask the Dominion Parliament to grant a charter for an electric railway to run from London to Aylmer, Ont., via Belmont and continuing on to Port Burwell. This electric line has long been deemed a necessity.

Plans for a comprehensive sewerage system for the whole northern half of the city of Toronto, including old North Toronto, Moore Park and Cedarvale, have been completed by the Works Department. It is estimated that the cost of the work will run into several million dollars.

At Toronto the approximate value of the buildings for which permits were taken out between January 1st and September 30th was $22,410,289. This is a slight gain over the 1912 return for the corresponding period, which was $22,240,383. Last month's total of $1,577,518 compares with $2,922,563 for September, 1912.

The oldest house in Montreal, the Lacroix mansion, built about 1636, on a site granted to a wealthy merchant of those days by Paul de Chomedy, Sieur de Maisonneuve, first governor of the city, has been saved by the efforts of the Numismatic and Antiquarium Society from the encroachments of the street extension campaign.

Building permits issued at Vancouver, B.C., during the nine months of the current year, ending September 30th, represented a total value of $9,774,038, compared with $12,722,097 for the corresponding period of last year. The September figures are $1,340,096 and $1,570,395 respectively. Mr. S. H. Jarrett is building inspector at Vancouver.

An important contract was let recently to the R. J. Lecky Company, of Regina, this being for the construction of the new traffic bridge over the river at Twenty-fifth street, Saskatoon. The contract price was $398,000. Three tenders were received for the work, that of T. J. Robertson amounting to $604,000, and that of Parsons Bros. to no less a sum than $837,000.

Messrs. Nicholas & Sproat, architects, of Vancouver, have put in a claim to the Winnipeg board of control for $800, for plans for a new city hall which they submitted during a recent open competition here. The plans did not win a prize, and while on their way back to the Vancouver firm were lost in transit by fire at Medicine Hat. The architects hold that the city is responsible.

Plans for two additional pumps are being prepared by the waterworks department of the Montreal Council. The consumption of water is rapidly increasing, and provision is being made for pumping a further ten million gallons per day. Two pumps of 12 million gallon capacity are being made by the John McDougall Caledonian Ironworks Company, Limited, and the further two pumps for which plans are being drawn up will be required by June next.

Building permits in Toronto for September amounted to $1,600,000, as compared with $2,922,563 for September, 1912. Statistics for the year to date are much more promising. Permits to the value of $23,898,642 were issued in the first nine months of 1913, while in the same period of last year the total amounted only to $22,240,383. The total value of permits issued in the whole of last year was $27,401,761, so that approximately $3,500,000 will be required in the coming three months to equal that record.

Messrs. J. G. White & Company, the eminent British harbor engineers, have secured a contract involving some six million pounds sterling, for a scheme of harbor extension in Vancouver, where the provincial government recently granted shore rights to the Vancouver Harbor and Dock Extension Company. Huddleston & Vigers, and Hansley Heenan, late British admiralty engineer, are also joint contractors. It is intended to provide 25 miles of dockage at Lulu Island and Sea Island, and many miles for industrial sites and railway terminals.

Having secured transfer of the city hotel license, Mr. J. C. Tapping, licencee, will proceed as soon as possible to build a new and up-to-date hotel in the city of Revelstoke. This modern structure will be erected on the property close to the corner of First street and Orton avenue, at an approximate cost of $40,000. Plans and specifications are now being drawn. It is intended to have frontage on First street of 75 feet and a depth of 65 feet. The building will consist of either brick or concrete, with a basement and three floors. It is hoped to have the contract completed in time for occupancy by the coming Christmas.

Montreal's water consumption is increasing so rapidly that, though two new twelve-million gallon pumps are being added this autumn to the existing plant, plans are already being prepared for the purchase of two more pumps of the same capacity, which will be delivered next June. During the past summer the maximum daily consumption reached the high figure of 53,000,000 gallons, which is an increase of about 7,000,000 gallons over last year, and, as it is anticipated that the water consumed in Montreal next year will show even a greater increase than has been the case this season, arrangements are being made to cope with an augmentation of about 10,000,000 gallons. Hence the necessity of ordering two more pumps.

A. Robertson, superintendent of construction at the Hudson's Bay company's store and warehouse at Edmonton, where extensions and improvements estimated to cost $250,000 are being made, reports that the two buildings will be ready for occupancy in December. The store, which is being remodelled, will be four storeys high in front, 105 by 100 feet, and 50 feet in the rear. Three passenger elevators and one for freight will be installed. These will all be operated by electricity generated on the premises. Other improvements are electric ventilating fans throughout the building. Twenty feet north of the store and connected with it by an underground passage, a substantial brick warehouse of five storeys has been erected. The second floor, in which the district offices will be opened, is being subdivided into suitable spaces. The other portions of the building will be used for wholesale purposes, without subdivision. The basement of the warehouse contains the plant by means of which the combined buildings will be heated, also a complete plant for the generation of electricity to be used in many direct ways for lighting and power. Heat is obtained from two 150 h.p. return tubular boilers. The boilers are also to be used to provide power for driving the machinery by means of which electricity for light and power is generated. The electrical power is obtained from two 100 kilo. turbines, supplied by the Westinghouse Company. A refrigerating plant, with a capacity of 10 tons, will be put in for use in connection with the cafeteria, and an air-compressor, by means of which the cash boxes to be used in the store will be operated, will be connected with the same set of machinery.

Canadian Railroad Development

The new C. P. R. elevator at St. John will be ready to handle grain by December. It will have a storage capacity of 1,032,000 bushels. The cost will be $600,000.

The new Canadian Northern line between Toronto and Ottawa is now completed and a regular service has been installed. The new route shortens the journey between Toronto and Ottawa by sixteen miles.

Good progress is being made on the main line of the Grand Trunk Pacific Railway towards Prince George. Steel is now at mile 1200 from Winnipeg and it is expected that the track will reach Prince George in a month or so.

The fourth and last span of the C. P. R. bridge across the St. Lawrence at Lachine has been placed in position by the Dominion Bridge Company, which have the contract for the steel work. The placing of the span—400 feet long—was under the direction of Mr. P. B. Motley.

The Canadian Pacific Railway have awarded a contract to the John S. Metcalf Company, Limited, constructing engineers, Montreal and Chicago, for the extension of the Glen Arch at Westmount, P.Q., in order to provide for a width of four tracks. The estimated cost is $50,000.

The officials of the Grand Trunk and Grand Trunk Pacific Railways are said to be considering the removal of their terminals and offices from Boston and Portland to St. John, N.B. Mr. E. J. Chamberlin, president of the Grand Trunk Railway, is expected to visit St. John within the next few months.

Messrs. Warren & Wetmore, of New York, have been appointed architects to draw up plans for the new C. N. R. station to be constructed in connection with the Mount Royal tunnel and the proposed electric train service from Montreal to the Model City. Plans will shortly be drawn up, but construction of the station will not be commenced until the spring.

Track-laying on the Regina-Moose Jaw & North Westerly Branch of the Grand Trunk Pacific Railway has just been completed to mile 91, a short distance beyond Mawer, Sask., fifty miles west of Moose Jaw, and within a few miles of the Saskatchewan River. Permission has been granted by the Board of Railway Commissioners for operation of this line, and as this is one of the greatest grain-producing lines in the west, a heavy traffic will move this season.

Two contracts in connection with the extension of the Montreal & Southern Counties Railway Company have just been let to Messrs. Ross & McComb. They will build the sub-structure of the bridge to be constructed across the Yamaska River at Cesaire, P.Q. The bridge will have four piers and two abutments, and is to be completed by the spring. Ross & McComb will also construct the company's extension through the town of Granby. A new sub-station is to be erected at Rougemont, and the company are adding a dozen new coaches to their equipment, some being the largest yet used on the line.

Work on the new Grand Trunk Railway station now undergoing construction at Stratford, Ont., is proceeding rapidly. The main station building is 151½ feet long and 60 feet wide. The tower will reach to 60 feet in height. The building is being constructed of granite and vitrified brick on a heavy concrete foundation. The roof will be of green slate. The umbrella roof connecting station and express building will have 43 feet spread. In connection with the new station the extensive railway yards are to be entirely relaid, although this will only be partially done this year, a portion of this work being deferred to next spring.

The grade revision of the entire system of the Intercolonial Railway will be started on the Cape Breton section of the road as soon as authority for the expenditure has been obtained from parliament, while the surveys are about completed for the change between River du Loup and St. Flavie, where the grades are heavy. Engineers are, in fact, going over the whole system and in good time better grades and curves will be secured. The Intercolonial management is also improving the stations, which are being generally overhauled, while fine new structures are being built at Bathurst and Sussex, in New Brunswick, and at Truro, in Nova Scotia. The last-named will be one of the finest station buildings in the Dominion.

Track-laying on the main line of the G. T. P. Railway is proceeding towards Prince George at a rapid rate. Steel is now at mile 1200 from Winnipeg. A short check was experienced at mile 1190 where the railway for the second time crosses the Fraser River. Track-laying was held up for a short time while the steel bridge across the Fraser River was completed. This obstacle has now been successfully passed and the track-laying machines are steadily pushing their way forward. The Fraser River is crossed for the third time about forty miles west of the second crossing, but the bridge here will not be allowed to delay track-laying, temporary trestle being erected to get the steel across the river. The steel bridge will be put in place shortly after, and towards the end of November the track should reach Prince George.

The C. N. R. have let the contract for the electrification of the Mount Royal tunnel and terminals to the Canadian General Electric Company, Toronto, the cost being about $500,000. The contract includes the supply of seven electric locomotives, in addition to multiple unit cars, and the complete installation of apparatus. The cars, eight in number, will be used for the local service between the Model City and Montreal. Yards will be established near Back River, and will give facilites, in the case of the C. N. R. ordinary service, for changing from steam to electric locomotives, as no steam locomotives will enter the city. A direct current of 2,400 volts will operate the system, and a seven-minute service through the four miles between the city and Mount Royal will be given. Provision will be made for the extension of this system at any time to any part of the service.

C. P. R. Five-Mile Tunnel in B. C.

The building of the C. P. R. tunnel, five miles long, at Rogers' Pass, B.C., in connection with the double-tracking work between Calgary and Vancouver, has been let to Messrs. Foley, Welch & Stewart. In addition to the boring of the tunnel, the contract calls for the construction of 11.1 miles of double track approaching the eastern portal and 2.3 miles of double track approaching the western portal.

The work will reduce the height of the summit at which the line crosses the Selkirks by 537 feet; will eliminate 4.4 miles of distance and 2,500 degrees of curvature, and on 15 miles of track the gradient will be reduced from 2.2 per cent. to 1 per cent. Nearly five miles of snow sheds will be eliminated from the system by the work of the tunnel. Nothing will be done this year in the way of starting work on the approaches to the tunnel; but the camps have been set up, and the boring machinery has arrived, and, as far as this important work is concerned, there will be no delay. The tunnel, which will be on a tangent throughout its entire length, will be on a .93 per cent. gradient, ascending west, and will be a single one, carrying a double track, 30 feet wide by 20 feet high.

A new method of construction has been adopted for boring the tunnel. Instead of boring simply from the two ends, it has been decided to bore a pioneer tunnel, 7 feet by 8 feet, parallel with the main tunnel and cross-cut at short intervals so as to enable several headings to be worked simultaneously. In the case of this particular tunnel, which will be an exceedingly interesting piece of work, the height of the mountains through which it passes precludes the possibility of vertical shafts being used. The pioneer tunnel will aid in the ventilation of the railway tunnel during its construction. The boring of the pioneer tunnel has actually been started and the first cross-cuts will be made when these have been driven about 2,000 feet. About the end of December of this year this part of the work will have been completed. The plant for boring the tunnels alone will cost half a million. Before the work is complete, it will cost the C. P. R. in the neighborhood of $10,000,000. Thirty feet of boring per diem is the estimate of Mr. A. C. Dennis, who is in charge of the work. Sometimes the men in the Canadian Northern tunnel make as much as forty and fifty feet per day; but, again, when they strike a difficult piece of rock they are lucky if they make thirty feet in the day. It will take three years to complete the bore, from which about 250,000 cubic yards of material will be taken out by way of the pioneer tunnel.

One of the features of the work, which will be of the greatest interest and value, considering that it means the piercing of the heart of a great mountain range and is on a parity with the boring of the Alps many years ago, is the erection of model villages at the two portals of the tunnel at a cost of $50,000. The floors of the houses at Glacier, are to be eight feet from the ground, with bridges to connect the houses with the work.

Personal Mention

Dr. Karl Imhoff, of the Emschergenossenschaft, Germany, arrived recently in New York City to spend his annual vacation in the United States and Canada. He will remain several weeks and will probably visit Atlanta, Cleveland, Toronto and several other eastern cities before returning.

To Lecture in Railway Engineering at McGill

Mr. W. C. Willard, who, as announced recently in this journal, has just been appointed Assistant Professor of Rail-

Mr. W. C. Willard, new Lecturer in Railway Engineering at McGill University.

way Engineering at McGill University, is a graduate of Lehigh University, where he obtained the degree of C.E. and M.S. Further in the matter of qualifications, Mr. Willard is an Associate Member of the American Society of Civil Engineers and of the American Railway Engineering Association. Mr. Willard's experience has been of a varied character. One of his earliest appointments was as chief of a locating party on the Tidewater Railroad in Virginia. Later he became instructor in railway engineering at the summer school of surveying at the University of California. Another academical post was that of professor of railway and highway engineering in the State College of Washington. His municipal experience has been obtained in the cities of Hot Springs, Ark., Portland, Ore., and Oakland, Cal. The position which he resigned in order to accept his present appointment was that of engineer of transportation facilities for the Panama-Pacific International Exposition, San Francisco. Mr. Willard has been a frequent contributor to the technical press of the United States.

Mr. Geo. Janin, chief engineer of the Montreal Council, has received an increase in salary of $1,000, making a total of $7,000 per annum. The salary of Mr. Stuart Howard, head of the Sewers Department, has been raised from $4,000 to $4,500; that of Supt. Lesage, of the Water Department, from $4,000 to $4,500; and that of Mr. Parent, superintendent of lighting, from $3,000 to $3,500.

Trade Notes

In the notice of Parian ware published on page 67 of our issue of October 1st we omitted to say that the Canadian General Electric Company, Limited, Toronto, were the selling agents.

The Raymond Construction Company, Limited, of Montreal, are opening a Toronto branch office, which will be in charge of Mr. H. C. Wotherspoon. The company have a number of contracts in hand at Montreal and in extending their field there is every argument in favor of their success. Mr. Wotherspoon was formerly with the William Grace Company, the Chicago contracting firm, as manager and superintendent in charge of work at Hamilton and Niagara Falls.

The B. F. Sturtevant Company of Canada, Limited, have shipped the first fans constructed at their factory at Galt, Ont. The company have opened an office at 919 New Birks Building, Montreal, being now directly represented instead of through an agency. The following orders have recently been secured: Dandurand Building, Montreal, fan, motor, etc.; Chapleau, Ont., C. P. R. round house, fan, engine, heater, etc.; Station H Post Office, Bishop and St. Catherine Streets, Montreal, fans, motors, heater, and air washer; National Breweries, Limited, Colborne and William Streets, Montreal, fans for ventilation of new stable, motors and sheet metal work.

H. B. Hebron & Company, of Montreal, and the Canadian Bitumastic Enamels Company, of Toronto, have joined forces, and are now operating under the name of the Canadian Bitumastic Enamels Company, Limited, at 55 St. Francois Xavier Street, Montreal, and 720 Traders Bank Building, Toronto. This firm holds the agency rights for the provinces of Ontario and Quebec of the famous Bitumastic materials manufactured by Wailes, Dove & Company, Limited, and have made plans to take contracts to apply their own materials where specified. In this they are following the plan of Wailes, Dove & Company, who have found that the success of their materials in every instance is largely due to their refusal to sell any of their products—with the exception of Bitumastic Solution—unless it is applied by their own men.

Book Reviews

Text-Book on Highway Engineering. By Arthur H. Blanchard, Professor of Highway Engineering, Columbia University, New York, and Henry B. Drowne, Instructor in Highway Engineering, Columbia University. 762 pages, 234 figures. Cloth $4.50 net. Publishers' Agents: Renouf Publishing Company, 25 McGill College Ave., Montreal.

Professor Blanchard has been so active in promoting the science and art of highway engineering, and he has done such excellent work at Columbia University—work whose influence has been felt in Canada and more remote fields by virtue of frequent contributions to the technical press—that this book cannot fail to be received with much interest. The book is written primarily from the standpoint of the instructor and the student, giving, first, the logical order and arrangement of the subject matter, and second, sufficient detail to thoroughly acquaint the student with the particulars and practice of modern highway engineering. At the same time the book is sufficiently broad in its scope and content with reference to the materials, construction, maintenance, specifications and cost data, to serve as a comprehensive reference book for the experienced engineer. All phases of the subject of modern highway engineering are treated.

Several chapters will be found that are somewhat of an innovation in books on roads and pavements, as, for example, the chapters on "Preliminary Investigations," "Surveying and Mapping," "Design," "Bituminous Materials," "Dust Prevention by the Use of Palliatives," "Bituminous Surfaces," "Bituminous Macadam Pavements," "Bituminous Concrete Pavements," "Concrete Pavements," and "Economics, Administration and Legislation." Two hundred and forty-two pages have been devoted to the subject of bituminous materials and their use in the construction and maintenance of roads and pavements.

The writings of eminent engineers and chemists have been drawn upon in order to transmit directly to the reader the views of experts on special subjects. Standard specifications and reports of national societies have been quoted liberally.

Hydraulic Turbines. By R. L. Dougherty, Assistant Professor, Sibley College, Cornell University. Price $2.00 net. McGraw Hill Book Company, Inc., New York.

A practical treatise which should prove of value both to the student and to the practising engineer. The book is designed especially for those who find it necessary to be familiar with the construction of turbines, to understand their characteristics, and to be able to make an intelligent selection of the type and size of turbine for any given set of conditions. The broad problem of the development of water power is treated in a very general way so that the reader may understand the conditions that bear upon the choice of a turbine.

The purpose of the text is to give the following: a general idea of water-power development and conditions affecting the turbine operation, a knowledge of the principal features of construction of modern turbines, an outline of the theory and characteristics of the principal types, commercial constants, means of selection of type and size of turbine, cost of turbines and water power and comparison with cost of steam power. A chapter is also added on centrifugal pumps.

The following is the programme of the 1913-14 winter session of the Canadian Society of Civil Engineers, the meetings being held at the rooms of the society, 176 Mansfield Street, Montreal; Oct. 16, Monthly; Oct. 23, General Section; Nov. 6, Monthly; Nov. 20, Electrical Section; Dec. 4, Mechanical Section; Dec. 18, Monthly; Jan. 8, Mining Section; Feb. 5, Monthly; Feb. 18, General Section; March 5, Monthly; March 18, Electrical Section; April 2, Mechanical Section; April 9, Monthly, and April 23, Mining Section.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

London, Ont.
Asphalt pavement, Clarence and Richmond Sts., for City Council. Mayor, C. M. R. Graham. Chairman Board of Works, B. W. Bennett. Engineer, W. N. Ashplant. Plans in progress.

Montreal, Que.
Sewers, Queen Mary's Park, for City Realty Investing Co., Ltd., 41 Mayor St. Engineer, Thos. Iverson, 10 Cathcart St., Montreal. Tenders closed on Sept. 15th for this work but it was decided to hold it over until spring.

Water pump. Engineer-in-charge, Supt. Lesage, Water Works Dept., City Hall. Plans being prepared to supply four 12,000,000 gal. pumps. Two to be installed this year and 2 next June.

Peterboro, Ont.
Sewage Disposal Plant. Chairman Board of Works, Wm. Buller. New plans to be prepared by Engineer, R. H. Parsons, owing to certain recommendations made by Prov. Board of Health.

Stamford Twp., Ont.
Waterworks, cost $30,000, for Twp. Council. Clerk, Carleton Munroe, Southend. Engineer, J. C. Gardner, Queen St., Niagara Falls. Ratepayers will vote on by-law Oct. 29th. About 1½ miles, 4, 6 and 8 in. iron pipe.

Toronto, Ont.
Works Commr. Harris recommends cement concrete sidewalks on 25 streets. Estimated cost $35,500. Board of Control. Mayor, H. C. Hocken.

Pavements for Board of Control. Mayor, H. C. Hocken. Commr. of Works recommends asphalt pavement on Tyrrel, Hain, Oakwood and Eastmount, cost $14,152. Brick block on Inkerman Ave., cost $2,505.

Water and sewage plants planned by Town Council of Leaside. Mayor, R. J. McRae. Plans have been approved by Ontario Board of Health. Tenders for installation to be called shortly.

Street grading. Works Commr. Harris recommends grading Roxton Road. Estimated cost $19,000, also Colina Ave., Hallawell, Ardagh, Main and Minto Sts. Estimated cost $7,672. Board of Control. Mayor, H. C. Hocken.

Winnipeg, Man.
Water system, cost $13,500,000, for Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St. By-law carried by ratepayers to raise above sum for bringing water from Shoal Lake.

CONTRACTS AWARDED

Ottawa, Ont.
Asphalt pavements planned. Mayor, J. A. Ellis. Engineer, Archibald Currie. Pavement on Clarence St., between King and Chapel, awarded to Union Construction Co., Bank St., $12,904. Pavement on O'Connor St. between Queen & Laurier, to Ottawa Construction Co., Elgin St., $8,378.

Sydney, N.S.
Addition to pumping station for City Council. Clerk, J. J. Curry. Engineer, D. McD. Campbell. General contractor, Owner.

Toronto, Ont.
Pavement, cost $31,000, Terauley St., for Board of Control. Mayor, H. C. Hocken. Work to be done by day labor under Works Dept. Treated wood block, between Queen and Agnes Sts.

Winnipeg, Man.
Granolithic sidewalks for Municipality of Assiniboia. Clerk, Frank Ness, Kirkfield Park P. O. General contractors, Dominion Constr. Co. Sidewalks on Portage Ave. from Albany Ave. to Deer Lodge.

Block pavement, cost $1,005.75, for Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, Engineer of Construction, J. W. Astley, City Yards. Cedar block paving, Strathcona St., from Talbot Ave. to part 135 ft. N.

Railroads, Bridges and Wharves

Berlin, Ont.
Conduits for C. P. R. and G. N. W. Telegraph Companies and Bell Telephone Co. Dominion Railway Board ordered wires to be placed underground on Queen St. N. The City applied for order to compel B. T. Co. to place its wires underground on King St. from Wellington St. to Waterloo Boundary. Order reserved.

Brantford, Ont.
Grand Trunk Railway will build siding into premises of the Ham & Nott Co., Ltd., Block G, North of Bruce St.

Cariboo Dist., B.C.
Wye track for G. T. P. Railway at mileage 29 west of Yellowhead Pass.

Edmonton, Alta.
Grand Trunk Pacific Railway will construct spur for the Park Lumber & Planing Mills Ltd. Block 10, Cromdale Subdivision of River Lot 24.

Foremost, Alta.
Station for C. P. Rly. Approved location of station on Weyburn, Sterling Branch.

Glace Bay, N.S.
Dredging for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until 4 p.m. Oct. 23rd. Plans, etc., at Dept., Ottawa.

Montreal, Que.
Spur for G. T. P. Rly. Siding and spur for Oglivie Flour Mills Co., west of Mill St.

Ottawa, Ont.
Boiler and engine house, cost $12,000, Middle St., for Ottawa Elec. Rly., 248 Albert St. 90 x 71, solid brick construction. Plans ready.

Stratford, Ont.
G. T. P. Rly. will construct siding near Gore Street.

Station, cost $60,000, Shakespeare St., for G. T. Rly. Dist. Engineer, W. A. Siegner. Supervisor, Wm. Cayley. Foreman E. Chandler, in charge of mason and brick work; Foreman H. Ellison, in charge of carpentry work. 151½ ft. x 60 ft., concrete foundation, granite and vitrified brick construction, green slate roofing. Railway yards to be entirely relaid.

Swift Current, Sask.
Canadian Pacific Railway will construct spur for Swift Current Grocery Co., Ltd., and Winnipeg Paint & Glass Co., Ltd., subject to condition of town.

Toronto, Ont.
Bridge, Gerrard St., for Board of Control. Commissioner of Works, R. C. Harris, City Hall. Tenders addressed to Chairman, Mayor H. C. Hocken, received until noon, Nov. 25th, for the supply and erection of structural steel work. Specifications, etc., at office of Railways & Bridges Section, Dept. of Works, City Hall.

Bridge, Centre Island, for Board of Control. Mayor, H. C. Hocken. Tenders received by Board until October 21st for a reinforced concrete bridge between Centre and Olympic Islands. Plans, etc., at office of Railways and Bridges, City Hall.

Winnipeg, Man.
C. P. Rly. will construct spur for Northern Elevator Co., Ltd.

Canadian Pacific Railway will construct spur into the premises of G. F. Stephens & Co., Ltd., on lot 64 Parish of St. Boniface. Subject to certain conditions.

CONTRACTS AWARDED

Brandon, Man.
Street car barns, cost $20,000, for City Council. City Clerk, Harry Brown. Chairman Street Rly.'s, Ald. Cater. Engineer, Supt. Antonisen. Masonry, carpentry and plastering, Willows & Co., 44 Clement. Block steel and roofing, Brandon Machine Co., 13th St. Steam heating, J. E. Yates, 29 9th. Plumbing, Brandon Heating Co., Bell Block. Electrical, Brandon Elec. Light Co., 10th St. One storey, 95 x 145.

Public Buildings, Churches, Schools, etc.

Fredericton, N.B.
Extension to hospital contemplated by City Council. Architect, F. Neil Brodie, 42 Princess St., St. John. Plans are not yet prepared, nothing will be done this year.

Guelph, Ont.
New school contemplated by Board of Education. Chairman, J. M. Duff. Plans will be prepared for additions to present Collegiate Institute and also plans for new building.

Hamilton, Ont.
Young Women's Christian Assn., Main St., will canvass the city to raise $50,000 for new building on Main St. Architects, Mills & Hutton, Room 804, Bank of Hamilton Bldg.

Lethbridge, Alta.
Church, cost $6,000, 7th Ave. and 12th St., for Mormon Congregation. Architect, E. Carrer. One storey, 35 x 55, Lethbridge brick construction, concrete foundation. Plans in progress.

Milverton, Ont.
Public Building for Dom. Govt., Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa, until 4 p.m., Nov. 3rd. Plans, etc., at offices of J. S. Russell, architect, Stratford, Ont., Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto. Postmaster, Milverton and at Department, Ottawa.

Montreal, Que.
Fire station contemplated for the Town of Maisonneuve. Mayor, Mr. Michaud. To be equipped with latest fire apparatus. Plans will be prepared.

Gymnasium club for L'Association Athletique Hochelaga, Inc., c/o J. A. Santoire, 1892 St. Catherine E. Work will not start until spring.

Public bath, extended time, 179 Ontario St. W., planned by Board of Commissioners. Sec., L. N. Senecal. Architect, Dalbe Viau, 76 St. Gabriel St. Tenders received by Commrs. till Oct 17th. Plans, etc., at office of Architect.

Alterations to City Hall, Notre Dame St., for Board of Commrs. Sec., L. N. Senecal. Architects, Marchand & Haskell, 164 St. James St. Plans will be ready to call for tenders in about two weeks.

Fire station, Young and Ottawa, for Board of Commrs. Sec., L. N. Senecal. Architect, D. J. Spence, 46 Beaver Hall Hill. Plans ready, tenders to be called about Oct. 16th.

Peterboro, Ont.
Orange hall, cost $12,000, for Black Knights of Ireland Lodge, 137½ Simcoe St. Further information from J. Batten, 189 Simcoe St., or R. Wilson, 584 Charlotte St. Brick construction.

Powell River, B.C.
Lock-up planned by Prov. Govt. Dept. of Public Works. Engineer, J. E. Griffith. Plans and specifications at office of Mr. T. Baird, Govt. Agent, Cumberland, Prov. Constable, Powell River, or at Dept., Victoria. Tenders received until noon Oct. 15th.

St. Thomas, Ont.
Tenders received by Architect, John T. Findlay, until Oct. 24th, for construction of Y. M. C. A. building. Plans at office of Architect.

Toronto, Ont.
School, College and Brock, for Separate School Board. Chairman Bldg. Com., Joseph Cadaret, 24 Duke St. Plans, etc., at office of Architect, C. J. Read, 404 Confed. Life Bldg. Tenders received by Chairman until Oct. 15th.

School, Annette and Evelyn, for Separate School Board. Chairman. Bldg. Com., Joseph Cadaret, 24 Duke St. Architect, C. J. Read, 404 Confed. Life Bldg. Plans, etc., at office of Architect. Tenders received by Chairman until Oct. 15th.

Commercial High School, cost $200,000, planned by Board of Education. Sec.-treas., W. C. Wilkinson, City Hall. Plans provide for 24 class rooms with assembly room in centre, kitchen and lunch rooms in basement. Principal Eldon and Building Supt. Bishop will go over plans and present any necessary alterations at next meeting of Advisory Committee. Tenders will be called shortly.

Windsor, Ont.
Theatre and stores, cost $100,000, Pitt St. E., for Empress Theatre Co. Promotor, E. E. McEwan. Architect, J. C. Pennington. Plans under way.

Winnipeg, Man.
School, cost $25,000, planned, St. James, for Rural Municipality of Assiniboia, St. Charles, Town Hall. Sec.-treas., F. Ness, Kirkfield Park P. O. By-law to be voted on shortly. Provision will be made for extension. Four rooms.

General hospital for City of Winnipeg. Sec. of Hospital Board, Geo. Stoker. By-law to raise $275,000 defeated Oct. 1st.

CONTRACTS AWARDED

Coquitlam, B.C.
School, cost $12,000, James Park, for School Board. Architect, J. Z. Long. General contractor, A. L. Larsens.

Hamilton, Ont.
Addition to theatre, cost $5,000, Mary St., for Dominion Theatres, Ltd., Mary St. Manager, E. R. Marshall. Architect and general contractor, Owner. Additional storey to be built over front of theatre for offices. Brick construction.

Main Duck Island, Ont. (Lake Ontario)
Station, cost $17,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Alex. McMaster, 74 Victor Ave., Toronto.

Montreal, Que.
Army hall, cost $30,000, City Hall Ave., for Salvation Army, 341 University. Architect, Major Miller, Toronto, Ont. General contractors, Reid, McGregor & Reid, Guy Block. Roofing, Richardson, Simard & Son, 745 Clarke Ave.

School, Longueuil, for School Commrs. of Longueuil. Architect, A. Prefontaine. Montreal. General contractors, mason, carpenter and painting, Guertin & Bouchard, 414 Parthenais. Steel, MacKinnon Holmes Co., Sherbrooke, Que. Roofing, heating, plumbing and electric, Bissonette, Coallien Laviguer, 803 Mt. Royal E. Three storeys, 60 x 80.

Ottawa, Ont.
Lavatory, cost $12,000, City Hall Sq. Mayor, J. A. Ellis. Architect, F. C. Sullivan, Castle Bldg., Queen St., has recommended awarding contract to Alexander & Campbell, 597 Lisgar St.

Regina, Sask.
Lodge hall, Retallack, for Sons of England. Sec.-Treas., E. Peachey, P. O. Box 1175. General contractor, Roger Edwards, 1667 Athol St.

Simcoe, Ont.
Sunday school, cost $7,000, for Baptist Church Congregation. Chairman Bldg. Com., W. A. Skirrow. Architect, L. D. Barber, Brantford. Work being done by day labor under supervision of Com. and Mr. Doughty.

Sydney, N.S.
Hospital. Builders and Owners, Dominion Iron & Steel Co., Ltd. Owners doing all work. Equipment for an up to date operating room will be purchased. One storey, 20 x 25, concrete foundation, Sydney grey brick construction.

Toronto, Ont.
Theatre, cost $8,000, Queen St. W., for "Bentley" (in trust), 16 Victoria Street. Architect, F. R. Cowan, 202 Crawford St. General contractor, Thos. Essery, Confederation Life Bldg. Brick and steel construction, brick foundation.

Welland, Ont.
Church, cost $40,000, Hellems Ave. and Griffith St., for A. W. Holmes, 10 Bloor St. E., Toronto. Contract to be awarded shortly.

Yorkton, Sask.
Monastry and church, cost $35,000, for Redemptionist Brothers. General contractors, Newert Constr. Co. Two stys., brick and stone construction.

Church, cost $5,000, for German Lutheran Church. General contractor, E. A. Rahn. One storey, brick construction and foundation.

Business Buildings and Industrial Plants

Berlin, Ont.
Factory, for Walter G. Rumpel. Will erect felt factory in North Ward. Plans under way.

Calgary, Alta.
Garage, cost $6,000, East Calgary, for Calgary Malting Co. One storey, 92 x 42, reinforced concrete construction. Plans ready.

Dairy barn, cost $3,000, for J. A. Knolpfle. Two storeys, 28 x 40, frame construction. Plans ready.

Warehouse, 10th Ave. W., for Gray Campbell, Ltd. (J. J. O'Grady, McLean Block). Two storeys, 100 x 50, pressed brick construction. Contract to be awarded shortly.

Fredericton, N.B.
Coal shed, Aberdeen St., for The Northfield Coal Co., Minto, N.B. Pres., Hon. Jas. Barnes. Contract to be awarded shortly.

Goderich, Ont.
Extension to organ factory, for Goderich Organ Co., Ltd. Manager, Alex. Saunders. By-law carried by ratepayers Oct. 4th, granting fixed assessment of $20,000 to above company for 10 years.

Hamilton, Ont.
Office building, King St. W., for G. R. Hazelwood, 5 Osborne Chmbrs. Architects, Brown & Fryer, Clyde Block. Nine storeys, stone foundation, brick construction, felt and gravel roofing. Plans in progress.

Store, cost $10,000, King St. E. Architects and owners, Sparks & McKay, 122 Cannon St. E. Three storeys, stone foundation, brick construction.

London, Ont.
Garage, cost $15,000, Dundas St., for Arthur McClary, 400 Queens Ave. Archi-

tect to be selected. Two storeys, 40 x 120.

Montreal, Que.

Garage, cost $5,000, rear 240 Drummond, for R. B. Angus, 240 Drummond St. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, mason, carpenter and steel, Reid, McGregor & Reid, 14 Guy Block. Painting, none. Tenders for roofing, heating and electrical work received by General Contractor after Oct. 15th.

Store and ice cream parlor, cost $15,000, 322 St. Catherine W., for Geo. Nicholas & Co., 322 St. Catherine W. Architect, D. J. Crighton, Jacobs Bldg., Montreal. Contract to be awarded in about two weeks.

V. Boydell & Co., Manchester, Eng., contemplate erecting a factory here.

Alterations to bank, cost $5,000, 365 St. Catherine W., for Bank of British North America, 30 St. James St. Architects, Cox & Amos, 6 E. T. Bank Bldg., St. Catherine W. Nothing further will be done till next year.

Two garages, cost $12,000, Outremont (Ainslie), for R. Tourville and E. Ouellette, 58 Cherrier St. Architects, Barott, Blackadder & Webster, New Birks Bldg. Work will be started in spring. Two storeys, 25 x 70, concrete foundation, stucco and brick construction.

Orangeville, Ont.

Knitting factory for J. N. Doods, Alton, Ont. Architect, J. Francis Brown, Board of Trade Bldg., Toronto. Owner supplies material. Plans prepared.

Ottawa, Ont.

Store and residence, cost $6,000, for August Boehmar, Creighton St., New Edinboro. Double brick veneer construction. Plans in progress.

Regina, Sask.

Wholesale warehouse, cost $35,000, for Canadian Equipment & Supply Co., Ltd., Calgary, Alta. President, T. Alfred McAuley. Four storeys. Plans in progress.

Addition to warehouse, cost $20,000, for Regina Plumbing & Heating Co., Ltd. Architects, Storey & Van Egmond, Credit Foncier Bldg. Brick construction and foundation. Plans ready.

Sarnia, Ont.

Store, cost $10,000, for Jno. Felsinger, 144 Christina N. Two storeys and basement, 28 x 55, red pressed brick front, brick foundation, plate and prismatic glass, store fronts and fixtures, office fixtures. Plans in progress.

Stratford, Ont.

Factory addition, Erie St., for The Avon Hosiery Co., 82 Erie St. Local manager, W. Pearson. New building, 4 storeys, 95 x 60. City will be asked to guarantee $25,000 bonds.

Toronto, Ont.

Alterations to store and workshop, cost $6,000, for A. E. F. Sawtell, 882 College St. Architect, E. G. Giles, 26 Carling Ave. Work not to start for some time. Two storeys, brick construction and foundation, felt and gravel roofing. Plans drawn.

Vancouver, B.C.

Bank building, Dunsmuir and Granville, contemplated for Dominion Bank. Architect not selected.

Office building, cost $20,000, Hastings and Hornby, for E. A. Moris. Architect, Thos. Hooper. Eight storeys, concrete construction. Plans ready.

Victoria, B.C.

Garage, cost $4,000, for Sam McCrumond. Architect, C. Coates. Plans ready.

Store and apartments, cost $7,000, 1056 Caledonia Ave., for Scott & Sinclair. Two storeys, brick construction. Plans in progress.

Walkerton, Ont.

Foundry for Isadore Ellinghausen. Architect to be selected.

Welland, Ont.

Two stores and offices, cost $15,000, Main E., for Hugh A. Rose, Jr. Tenders received by architect, Thos. L. Nichols. Two storeys, 34 x 70, brick construction.

Winnipeg, Man.

Stores and offices, Main St. N., for N. Johnson, care architect, G. W. Northwood, 502 Northern Crown Bank Bldg. New plans being prepared.

Wyoming, Ont.

Box and basket factory planned for Daniel Senecal. By-law granting bonus to owner carried by ratepayers.

CONTRACTS AWARDED

Calgary, Alta.

Stores and bachelor apts., cost $50,800, 7th Ave. E., for P. O. Sullivan. Architect, J. B. Henderson, 812 Beveridge Block. General contractors, McDougall & Forster. Two storeys, 75 x 130, brick and reinforced concrete construction.

Edmonton, Alta.

Store and apartments, cost $6,000, 24th St., for C. R. Horne, 1700 24th St. Architect and general contractor, Owner. Two storeys, 32 x 50, frame and brick veneer construction.

Addition to office and rooms, cost $10,000, Jasper Ave., for Runnals & Nichols. Architect, E. C. Hopkins, 32 Jasper Ave. W. General contractors, Reed, MacDonald & Brewster, Tegler Block. Three storeys, 100 x 52 ft. 2 in., steel and brick construction.

Hamilton, Ont.

Addition to office building, King St. E., for A. B. McKay. Architects, Bond & Smith, 19 Wellington St. W., Toronto. General contractors, Harris & Harris, Confed. Life Bldg., Toronto. Two stys. addition, reinforced concrete and brick construction (Kahn System).

Lindsay, Ont.

Alterations to newspaper office for Allan Gillies, "The Warder." Office furniture required.

Magog, Que.

Business block, Lake St. Owners and general contractors, J. H. Percy & Son. Architect, private plans.

Store, Pine St. Owner and general contractor, F. H. Barlow. Walls started.

Medicine Hat, Alta.

Factory for Canada Cement Co., Hull Block. Manager, Mr. Leigh Hunt. Architects and builders, Hunt Engineering Co., Hull Block. Two storeys, cement, brick and steel construction.

Melville, Sask.

Business block, cost $15,000, for J. G. Jackson, 2nd Ave. General contractors, Melville Construction Co. Three stys., brick construction and foundation.

Montreal, Que.

Stores and flats, cost $20,000, Cote des Neiges Rd. Architect and owner, L. P. Godin, 1217 Cote des Neiges Rd. General contractor, E. Paquette, Maplewood ave., Cote des Neiges. Three storeys, 99 x 48, concrete foundation.

Stores and flats, cost $15,000, Cote St. Paul (Church and York Sts.), for L. Jacob, 1421 De Montigny. General contractor, Nap. Lavoie, 218 Bond Ave., Verdun. All other contracts to be given next week.

Garage, cost $5,000, rear 240 Drummond, for R. B. Angus, 240 Drummond St., Montreal. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, Reid, McGregor & Reid, 14 Guy Block. Other trades will be let shortly. One storey, 33 x 26, concrete foundation, fireproof, stone and brick construction.

Two stores and flats, cost $15,000, Outremont (Durocher St.), for Jos. Lebeau, 100 Parc Lafontaine, Montreal. Montreal. Architect, Z. Trudel, 238 St. Andre St. General contractor, A. Frenette, 212 Fabre St. Painting, J. C. Parent, 2518 Park Ave.

Store, cost $12,000, St. Catherine E., for Mrs. E. Lareau, 267 Mance St. Architect, Chas. Bernier, 70 St. James St. General contractor, A. Pion, 338 Marquette. Painting, S. A. Lanctot, 441 Marquette.

Store, cost $12,000, St. Catherine E., for Mrs. H. E. Vautelet, 69 Victoria Ave. Architect, Chas. Bernier, 70 St. James St. General contractor, A. Pion, 338 Marquette. Painting, S. A. Lanctot, 441 Marquette.

Bank and offices, cost $14,000, Verdun (Ethel Ave.), for Bank of British North America, 30 St. James St., Montreal. Architect and general contractor, C. J. Brown, 4263 St. Catherine W. Tenders for roofing, heating, plumbing and electric received by Architect after Nov. 1st. Two storeys, 35 x 40.

Store and flats, cost $25,000, Sherbrooke W., for Thos. Coggins, 319 St. Antoine St. Architect, Chas. E. Mitchell, 11 Beaver Hall Hill. General contractors, Jas. Adam & Co., 745 St. Catherine W. Roofing and plastering to be let about Oct. 15th. Painting, W. H. Reid, 4093 Sherbrooke St. Foundations in.

Four stores, cost $5,000, Windsor, for J. M. Guerin, 4 Edgehill Ave. General contractor, A. Watson, c/o Owner. General contractor will probably call for tenders on other trades about Nov. 1st. One storey, 29 x 26, concrete foundation, stone and brick construction.

New Denver, B.C.

Extension to powder plant for Steelits Explosives Co., Nelson. General contractor, A. Doucett, Seattle, Wash.

Rouleau, Sask.

Business block, cost $5,000, for W. F. Krauss, Main St. General contractor, E. E. Poole, Railway Ave. 2½-storeys, brick construction, concrete foundation. Excavating done.

Toronto, Ont.

Office building, cost $950,000, King and Yonge, for Guardian Realty Co., 501 C. P. R. Bldg. Architects, Ross & Macdonald, 1315 Traders Bank. General contractor, Geo. A. Fuller Co., New York, and Stair Bldg., Toronto. Steel, Dom. Bridge Co., Toronto. Terra Cotta, Fedtal Terra Cotta Co., 111 Broadway, New York. Granite, Stanstead Granite Quarries Co., Ltd., Stanstead Jct., Que. Lime stone, E. F. Giberson Co., Ltd., 10 Cathcart St., Montreal, Que. 20 storeys.

Two stores and 6 residences, cost $28,000, 63-79 Nairn Ave., for R. P. Cranfield, 155 Robert St. Plastering, Wm. Horwood, 491 Concord. Painting, J. O. Dougall, 275 Croft St. Heating, Hall Zryd Foundry Co., Manning Chambers.

Vancouver, B.C.
Store, cost $12,000, Main St., for A. E. Suchling. Architects, Stanley Milton & H. H. Gillingham. General contractors, J. J. Frantz Constr. Co. One storey and basement, reinforced concrete construction.

Victoria, B.C.
Addition to White Horse Hotel, Humboldt and Blanchard Sts., for Mrs. Godfrey. Architect, J. M. C. Keith, General contractors, Parfelt Bros. 36 room addition.

Windsor, Ont.
Office building, cost $30,000, Ouellette, for A. T. Currah. Architect, J. C. Pennington, Windsor. Iron and steel, Canadian Bridge Co., Walkerville. Plastering, Lockwood & Troop, Windsor. Three storeys, 50 x 90.

Addition to paint factory, cost $5,000, for Standard Paint & Varnish Co. Manager, J. A. Straith. Architects, Spier & Rhone, Detroit, Mich. Mason, Wm. James, Windsor. Carpenter, Chas. McNaughton, Windsor. Will purchase drill presses. Two storeys, 45 x 40.

Winnipeg, Man.
Stores and office building, cost $20,000, Main St., for W. Zimmerman, 669 Main St. Architect, M. Blankstein, 450 Dufferin Ave. General contractor, G. Martin, 80 Dubuc St., Norwood.

Alterations to bank, cost $12,000, Main St., for Canadian Bank of Commerce, Alexander Ave. Architect, Victor Horsburgh, Toronto. General contractors, Fraser & MacDonald, Gertrude Ave. Brick construction.

Store and residence, cost $7,000, Rosser and Hugo Sts., for Thos. Crone, 681 Jessie Ave. Architect, c/o Owner. General contractor, Mr. Beach, 228 Garry St. Two storeys, 24 x 42, stone and pressed brick construction.

Store, cost $5,500, Pacific Ave., for T. Ryan, c/o Thos. Ryan & Sons. General contractors and architects, McCabe & McKenzie, McIntyre Block. Pressed brick construction.

Residences

Drummondville, Que.
Apartment house, cost $9,000, for Alex. Mercure. Private plans being prepared. Two storeys, 132 x 50, stone foundation, artificial stone construction.

Durham, Ont.
Four residences, cost $10,000, Countess St. Architect and owner, Wm. McFadden. White brick construction, stone and concrete foundation. Plans in progress.

Galt, Ont.
Double residence for Wm. Dickson, 85 Barrie St. Tenders received by Owner for brick work and plumbing.

Hamilton, Ont.
Residence, cost $9,000, Mountain Top. Tenders received by Architect, F. W. Warren, Bank of Hamilton Bldg., until Oct. 18th. 2½-storeys, 46 x 32, building stone construction, stone foundation.

Montreal, Ont.
Six flats, cost $6,500, for Jno. Galipeau, 506 Moreau. Three storeys, 48 x 72. Plans prepared.

Nine flats, cost $9,000, Christopher Columbus, for Ernest Hamel, 1067 De La Roche. Three storeys, 25 x 60, stone foundation. Plans in progress.

Two flats, cost $8,000, Cote Des Neiges (Maplewood), for J. B. Bisson, Maplewood. Two storeys, 46 x 52. Plans prepared.

Apartment house, Stanley, for Jno. H. Hand, 609 Belmont Ave., Westmount. Architects, Wright & Son, 204 St. James St., Montreal. Building will probably not go ahead until spring. Depends on money market.

Flats, cost $8,000, Park Ave., for A. J. Bibeau, Park Ave., near Bernard St. Architect, A. St. Louis, 80 St. Gabriel St. Foundation, L. A. Ott & Co., New Birks Bldg. Tenders for all other trades received by Architect from Oct. 13th till Oct 18th. Concrete foundation, solid construction, felt and gravel roofing. Excavating done.

Residence, cost $20,000, Outremont. Architect, Chas. Chausse, 17 Pagnuelo Ave. Tenders called by Architect in about two weeks. Concrete foundation, stone and brick construction, felt and gravel roofing. Plans in progress.

Residence, cost $25,000, planned, Outremont. Tenders called by Architect, Chas. Chausse, 17 Pagnuelo Ave., in about two weeks. Concrete foundation, stone and brick construction, felt and gravel roofing.

Two flats, cost $9,000, Melrose, for W. A. Hayman, 225 Notre Dame W. Two storeys, 19 x 58, concrete foundation. Plans ready.

Six flats, cost $6,000, 347 St. Ferdinand, for Ovide Brunel, 425 St. Antoine. Three storeys, 36 x 42, concrete foundation. Plans ready.

Ten flats, cost $8,000, Chabot St., for A. Chausse, 1129 Mount Royal E. Subcontracts to be let as soon as possible. Concrete foundation, brick construction.

Two cottages, cost $25,000, Outremont (Ainslie) for Ouellette & Tourville, 58 Cherrier. Architects, Barott, Blackadder & Webster, New Birks Bldg. Work will be started in spring.

Residence, cost $7,174, Westmount (Grosvenor ave.) for W. S. Boyd, 325 Grosvenor Ave. Architects, Benoit & Girard, 215 St. Catherine W. Tenders will be called in spring.

Moose Jaw, Sask.
Residence, cost $8,000, River Park, planned, for A. Westwood, Walter Scott Bldg., Main St. Architect, Shalto Smith, Room 15, 36 Main St. Two storeys, 55 x 26, and wing, 20 x 15, frame, stucco and brick veneer construction, concrete and waterproof foundation, tile, slate or asbestos roofing.

Oak Bay, B.C.
Residence, cost $6,000, Landsdowne Road, for Henry Gilbert. Plans in progress.

Ottawa, Ont.
Residence, cost $5,000, Driveway, for D. L. Campbell, 141 Preston St. Two storeys, brick veneer and stucco construction. Plans prepared.

Residence, cost $10,000, Blackburn St. Architect and owner, W. E. Noffke, Central Chmbrs., Elgin St. Brick veneer and stucco construction. Plans ready.

Residence, cost $7,000, Monkland, for E. I. Shuttleworth, 24 Euclid. Architect, A. L. Weeks, Sparks St. 2½-stys., brick veneer and stucco construction. Plans prepared.

Residence, cost $5,000, Rosedale, for T. H. & R. J. Patterson, 62 3rd Ave. 2½-storeys, brick veneer and roughcast construction. Plans prepared.

Toronto, Ont.
One pair residences, $8,500, Summerhill, for R. Brown, 24 Carling Ave. Architect, W. G. Hunt, 935 Bloor St. W. Owner will call for tenders. 2½-stys., 39 x 43, brick construction.

One detached residence, cost $2,500, Edwin Ave., planned for O. Hoover, 136 Geoffrey St. Work not to start until spring. Two storeys, 23 x 34, brick construction, stone foundation.

Two detached residences, cost $5,000, Albertus Ave., for A. W. Blakeman, 33 Pears Ave. General contractor and carpenter, Owner. Plastering, painting, heating, plumbing and electrical will sublet. 2½-storeys, 20 x 34, brick construction and foundation.

Residence, cost $4,000, for J. H. McLaren, 7 Briar Hill. Architect, P. H. Finney, 79 Adelaide E. Brick construction and foundation, slate, felt and gravel roofing. Plans in progress.

Vancouver, B.C.
Residence, cost $9,350, Shaughnessy Heights, for J. P. Doherty, 1620 Alberni St. Work to be done by day labor. Two storeys, frame construction. Plans drawn.

Apartment, cost $130,000, Burrard, near Davis, contemplated for Smith & Smith. Architect not selected. Eight storeys, 35 x 120.

Apartment, cost $153,000, Hasting and Jackson, for Mordon & Thornton. Architects, Braunton & Leibert. Six storeys, brick and mill construction. Plans ready.

Apartment house, cost $60,000, Kitsilano, for T. H. Calland. Architect, W. F. Calland. Architect, W. F. Gardiner. Three storeys. Plans drawn.

Victoria, B.C.
Apartment building, cost $80,000, for A. McCrummon. Architect, L. R. Hazeltine is preparing plans.

Windsor, Ont.
Residence, cost $10,000, Ouellette, for A. A. Little. Architects, Leybourne & Whitney. Two storeys, 52 x 32, brick and stucco construction.

Residence, cost $5,000, for Geo. E. Copeland. Architects, Leybourne & Whitney. Brick construction. Plans being prepared.

CONTRACTS AWARDED

Calgary, Alta.
Residence, cost $6,000, Bankview, for J. J. O'Gara, McLean Block. General contractor, W. Cunningham. Two stys., 36 x 39, frame construction.

Edmonton, Alta.

Addition to residence, cost $40,000, Highlands, for W. J. Magrath, Highlands. Builder, Mr. Moorehouse, 27 Jackson Block.

Residence, cost $5,000, 26th St., for C. R. Horne, 1700 16th St. Architect and general contractor, owner. Two storeys, 30 x 32, brick and frame construction.

Hamilton, Ont.

Three residences, cost $10,000 each, Inglewood Drive. Owner and general contractor, L. Donaldson, 229 Bay St. S. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. 2½-storeys, brick construction, stone foundation, slate roofing. Excavating done.

Lennoxville, Que.

Tenement house, cost $4,000, Main, for Mrs. F. McFadden, 2 Fulton Ave., Sherbrooke. Architect, private plans. General contractor, A. Page. Day labor. Frame construction. Walls started.

Montreal, Que.

Residence, cost $8,000, Outremont (Hartland), for Geo. Goodbody, 545 Durocher Ave. Architect, D. O. Mounsey, 4th Ave., Verdun. General contractor, Owner—day labor. Two storeys, 25 x 40, stone foundation, brick construction.

Residence, cost $6,000, Westmount (Western Ave.), for Dr. A. Munroe, 61 Drummond St., Montreal. Architect, D. J. Spence, 46 Beaver Hall Hill. General contractor, mason and carpenter, R. Masson, 381 Victoria Ave. Roofing, Richardson, Simard & Co., 745 Clarke St. Plastering, Watson & Wilson, 1680 Hutchison St. Painting, A. Craig, 41 Jurors St. Heating and plumbing, Mr. Sanderson. Electrical, Goodwins, Ltd., St. Catherine W. Two storeys, 21 x 60.

Residences, cost $16,000, Outremont (Glencoe), for A. Morrison (& Robt. Dykes, 110a Stanley. Builder, G. W. Goodbody, 545 Durocher, Ave. General contractor, Owner. Day labor. Two storeys, 52 x 37 ft. 6 ins., cement foundation, stone and brick construction.

Residence, cost $16,000, Cote Des Neiges, for Carl Riordon, 374 Cotes des Neiges Road. Architects, Mac Vicar & Heriot, 104 Union Ave., Montreal. General contractor and painting, E. B. Evans, 74 St. Denis. Tile, Sanitary Tiling Co., 136 Bleury. Roofing, Sibley & Huot, 34 St. Martin. Electrical, Star Electric Co., 803 St. Catherine W. Interior fittings, H. Morgan & Co., Phillips Sq.

Four flats, cost $8,000, Old Orchard. General contractor and Owner, F. Lachapelle, 2589 St. Hubert. Work done by day labor. Two storeys, 50 x 64, concrete foundation.

Flats, cost $30,000, Verdun (1st Ave.), for J. A. Leclair, 276 Church Ave. Architect and general contractor, Owner. Day labor. Two storeys, 150 x 40.

Residence, cost $28,000, Outremont (Dunlop Ave), for C. H. Branchaud, 19 St. Famile St., Montreal. General contractor, D. M. Long, 39 Windsor Roofing, Richardson Simard Co., 745 Clarke St. Painting, W. J. Chapman, 4151 St. Catherine St. Heating and plumbing, Cadieux & Briard, 1277 St. Dominique St. Electrical, Spencer & Aspinall, New Birks Bldg.

Alterations to apartments, cost $5,000, for Astoria Apts. Architects, Mac Vicar & Heriot, 104 Union Ave. Montreal. General contractor, Wm. Irving, Guy Block. Heating and plumbing, Hickey & Aubet, 93 Dominion St.

Two residences, cost $12,000, Outremont (Querbes), for P. Guidazio, 304 Querbes Ave. Architect, A. Rouillier, c/o Owner. General contractor, Owner. Day labor. Two storeys, 25 x 33, stone foundation, pressed brick construction.

Montreal West, Que.

Residence, cost $8,000, Brock, for E. Garrigan, Brock St. Architect and general contractor, Owner. Cement foundation, encased brick construction, asbestos shingle roofing.

Residence, cost $8,500, Brock, for H. Doriss. Builder and general contractor, Owner. Cement foundation, encased brick construction.

North Battleford, Sask.

Residence, cost $25,000, J. Patterson, general contractor and owner. 2½ stys., brick and stone construction.

Quebec, Que.

Residence, cost $7,500, 61-63 St. Nazaire, for East & Mason, St. Nazaire St. General contractor and mason, owner. Four storeys, 25 x 30, 12 x 12, frame construction.

Regina, Sask.

Two residences, cost $8,000, Cameron. General contractor and owner, H. R. Goodhue, Cameron St. 2½-storeys, brick construction.

Residence, cost $5,000, Robinson. General contractor and owner, Robt. Hellaway, Robinson St. Frame and brick construction.

St. Catharines, Ont.

Alterations and additions to residence, cost $5,000, Queen St., for A. E. Nicholson. Excavation and mason, H. P. Nicholson. Carpenter, Williams and Mesler. Painting and glazing, Leach & Jones. Plumbing, H. A. Bald & Co. Heating, J. Peart. Two storeys, 24 x 45, brick, frame and stucco construction, stone foundation.

Toronto, Ont.

Apartments, Enderby. General contractors and owners, McMillin & Costain, 198 Main St., East Toronto. Owners doing work by day labor. 40 x50, concrete block construction.

One detached residence, cost $5,000, Edgar Ave. General contractor and owner, W. C. Sancto, 21 Isabella Street. Will sub-let some trades. 2½-storeys, 22 x 40, brick construction and foundation.

One pair residences, cost $6,000, Browning Ave. General contractor and owner, Jas. R. Gifford, 190 Pape Ave. Owner sub-lets. 2½-storeys, 32 x 40, brick construction and foundation.

One pair residences, cost $7,000, Havelock St., for Taylor & Nesbit, 18 Havelock St. General contractors and plastering, Owners. Mason, Wm. Woods, 32 Rusholme Park Cres. Carpenter, Deeths, Ltd., 44 Grove Ave. 2½-storeys, 36 x 42, brick construction. Owners will receive tenders for painting, heating, plumbing and electrical.

Residence, cost $3,000, Fairview Ave. Owner and general contractor, T. T. Johnston, 1 Sherwood Ave. Two stys., 20 x 38, brick construction, brick foundation, shingle roofing.

Three detached residences, cost $15,000, High Park. Owner and general contractor, S. Solodinsky, 2122 Dundas Street. Will sub-let plastering, painting, heating, plumbing and electrical. Two storeys, 24 x 52, steel and brick construction, brick foundation, felt and gravel roofing.

Apartment, cost $25,000, College St., General contractors and owners, Donnefield Bros., 62 Spruce Hill Rd. Will sublet plastering, painting, heating, plumbing, electrical. Three storeys, 48 x 62, brick and steel construction.

Three pair residences, cost $15,000, St. Clair Gardens. General contractor and owner, W. Pennock, 5 Burlington Cres. Owner buys all material. Foundation in one pair, excavating two pairs. 2½ stys., brick construction and foundation.

Residence, cost $6,000, Wells Hill Ave. General contractor, J. W. Brown, 229 Christie St. Architect, P. H. Finney, 79 Adelaide St. E. Owner will sublet some trades. 2½ storeys, brick construction and foundation.

Vancouver, B.C.

Residence, cost $5,000, Point Grey, for Dr. W. A. Briggs, 1847 2nd Ave. Architect, A. J. Bird. General contractor, J. E. Wright, 466 10th Ave. E. Two stys., frame construction.

Residence, cost $14,000, Shaughnessy Heights, for McKay Smith, 756 Jervis St. Architects, Maclure & Fox, Pacific Bldg. General contractors, Pudry & Lonergan, 1340 Barclay St. Three stys., frame construction.

Residence, cost $85,000, Selkirk Ave., Shaughnessy Heights, for A. E. Tulk. Architects, Maclure & Fox, Pacific Bldg. General contractors, McPherson & Sinclair. 2½ storeys, Los Angeles brick and stone construction, English tile roofing.

Residence, cost $14,000, for Thos. E. Ladner, 2nd ave. west. Architect, J. W. Kengey, Rogers Bldg. General contractors, R. & F. Watson, Kerrisdale. Three storeys, frame construction.

Victoria, B.C.

Apartments, cost $45,000, Cook and Collinson streets, for A. B. Winch, care architect, C. E. Watkins, Green Block. General contractors, Messrs. Fulton Bros. Four storeys.

Residence, cost $5,000, for M. Henderson. General contractor, J. Robertson. Two storeys, frame construction.

Welland, Ont.

Double tenement house, cost $4,500, Hellems ave., for J. C. Diffin, builder and general contractor. 2½ storeys, 33 x 38, brick veneer construction.

R. C. Parsonage, cost $12,000, Griffith, for R. C. Church Corporation, Welland. Architect, A. W. Holmes, 10 Bloor St. E., Toronto. General contractor, J. H. Gardiner, Welland. Hamilton pressed brick construction.

Residence, cost $7,000, North Main, for The Misses Chapman. Builder and general contractor, J. C. Diffin. 2½ stys., 30 x 40, brick veneer construction.

Windsor, Ont.

Residence, cost $6,000, Ouellette St. Builder and owner, Peter Osterhout. Two storeys, 40 x 40, brick construction.

Apartments, cost $18,000, Ferry, for Fred Dresch & Son. Architects, Leybourne & Whitney. Mason, Geo. Goodman. Three storeys, 34 x 50.

(Continued on page 72)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Kingsville, Ont.," will be received at this office until **4** p.m., on **Monday, October 27, 1913**, for the construction of a Public Building at Kingsville, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Kingsville, Ont.; at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Cor. Yonge and Charles Streets, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 1st, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48549. 41-42

Sealed tenders addressed to the undersigned, and endorsed "Tender for Breakwater at Kincardine, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the construction of a Breakwater at Kincardine, Bruce County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of H. J. Lamb, Esq., District Engineer, Windsor, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Kincardine, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46683. 41-42

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year 1914 for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,
Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada.
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine 42 45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Thornbury, Ont.," will be received at this office until **4** p.m., on **Wednesday, October 29, 1913**, for the Harbour Improvements at Thornbury, Grey County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. H. Armstrong, Esq., District Engineer, Midland, Ont., and on application to the Postmaster at Thornbury, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47674. 41-42

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to 2 p.m. on **Monday, October 27th, 1913**, for the digging and construction of the Bowes Award Drain in the Townships of Hullett and Morris.

Plans and specifications can be seen at the Clerk's office, Londesboro, Ont.

The lowest or any tender not necessarily accepted.

JAMES CAMPBELL,
41-42 Township Clerk.

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Wellington, Ont.," will be received at this office until **4** p.m., on **Wednesday, October 29, 1913**, for the construction of Harbour Improvements at Wellington, Prince Edward County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Wellington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation, and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46393. 41-42

ARCHITECT

For an experienced, up-to-date architect, an excellent proposition is offered, by an established Consulting Engineering & Architectural Corporation, based on a co-operative plan, offices in Cleveland, Detroit, Buffalo and New York City. The position requires a man who is thoroughly capable of handling an architectural department independently, both inside and outside work. Highest references and $1,500 investment required. Contract with salary, commission and interest in business guaranteed. Answer, "Architect," Contract Record, Toronto. 42

Tenders for Steelwork

Gerrard Street Bridge

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, November 25th, 1913**, for the supply and erection of structural steelwork for the Gerrard Street Bridge over the Don River.

Specifications and tender form may be obtained upon application at the office of the Railways & Bridges Section, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor.
Chairman, Board of Control.
City Hall, Toronto,
September 22nd, 1913. 42

Tenders for

Construction in Reinforced Concrete of Olympia Bridge

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, October 21st, 1913**, for the complete construction of a reinforced concrete bridge between Centre and Olympic Islands.

Specifications and tender form may be obtained upon application at the office of the Railways & Bridges Section, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted

H. C. HOCKEN, Mayor.
Chairman, Board of Control.
City Hall, Toronto,
October 8th, 1913. 42

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Milverton, Ont.," will be received until 4 p.m., on **Monday, November 3, 1913**, for the construction of a Public Building at Milverton, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the office of J. S. Russell, Esq., Architect, Stratford, Ont., at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the Postmaster, Milverton, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45635. 42-43

TENDERS

FOR

Pumping Engines, Boilers and Coal Handling Apparatus

Tenders will be received by registered post only addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on

Tuesday, November 25th, 1913.

for the installation of one or more 7½ and 20 million Imperial Gallon Pumping Engines, three Water Tube Boilers with Piping, and Coal Handling Apparatus at the High Level Pumping Station.

Specifications and tender forms may be obtained upon application at the office of Mr. James Milne, Mechanical and Electrical Engineer, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor.
Chairman, Board of Control.
City Hall, Toronto, October 9, 1913. 42

Addition to Lawrence's Bakery

Denison Ave., Toronto

Tenders will be received up to 12 o'clock noon, **Monday, October 27th, 1913**, on all trades for extensive alterations and additions.

The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the office of the architect,

GEO. W. GOUINLOCK,
42 1108 Temple Building.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on

Tuesday, October 21st., 1913

for the construction of the following sewers:—

Danforth Ave. Storm Overflow Sewer Sec. No. 2.
Eastern Ave. from Leslie St. to Knox St.
Lane 1st E. Spadina Ave. from Morris Ave. to Sussex St.
Lane 1st N. Davenport Rd. from Elmwood Ave. to McFarland Ave.
Victor Ave. from Carlaw Ave. to 464 feet west.
Lane 1st S. College St. from Crawford St. to Shaw St.
Jersey Ave. from 84 ft. 3 in. S. of Clinton Ave. to 47 ft. further south.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, October 8th, 1913. 42

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Residences

(Continued from page 69)

Winnipeg, Man.

Residence, cost $10,000, Dromore ave. Architects and general contractors, Andrews & Sons, Portage and Victor. 2½ storeys, 30 x 29, frame construction, stone foundation. Foundations in.

Residence, cost $3,000. Architect and general contractor, N. Milligan, 682

Strathcona street. Two storeys, 20 x 28, frame construction, stone foundation. Excavating done.

Residence, cost $20,500, for C. Henback, care architects, Woodman & Carey, Lindsay Bldg. General contractors, Claydon Bros., Furby Place. Two stys., 29 x 90, brick construction.

Apartment block, cost $75,000, Home St., for Roed & Lidholm, Union Trust Bldg. Architect, E. D. Tuttle, 709 McArthur Bldg. General contractors, owners. Work will start immediately. 3-storeys, 66 x 98.

Apartment block, cost $65,000, Grosvenor ave., for D. H. Bradley, care architect. A. B. Scarlett, 797 Jessie ave. General contractors, Winnipeg Stone Co. Elmwood. Three storeys.

Power Plants, Electricity and Telephones

Montreal, Que.

Generator for Board of Commissioners of Pointe St. Charles. Tenders received by Secretary, L. N. Senecal, until 12 o'clock noon, Oct. 23rd, for the supply and erection at Low Level Pumping Station, of 1 direct current electric generator of 35 kw. capacity, direct coupled to steam engine for electric lighting. Specifications and further information may be obtained at office of Superintendent of Water Works, City Hall, Montreal.

St. Catharines, Ont.

Sub-station and distribution system, cost $116,000, planned by City Council. Clerk, J. A. Pay. Ratepayers will be asked to vote on by-law Oct. 30th.

Winnipeg, Man.

Electric Wiring planned by Provincial Govt., Dept. of Public Works. Acting Minister, G. R. Coldwell. Wiring Principal's residence, farm foreman's cottage, swine barn and laying and brooding house, Agricultural College, St. Vital.

Ornamental street lighting, cost $3,109.50, planned by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Willoughby Kelso Co.

Yorkton, Sask.

Electric power house, cost $36,000, for Town Council. Clerk, F. T. F. Atcheson. General contractors, Ritchie & Watters. One storey, brick construction and foundation.

Miscellaneous

Calgary, Alta.

Cable required by City Council. Engineer, R. A. Brown. General contractors, Imperial Wire & Cable Co., Ltd., Montreal, for supplying 40,000 ft. lead covered paper insulated underground cable.

Stratford, Ont.

Fire apparatus for City Council. Fire Committee's report, recommending purchase of fire apparatus to cost $20,000, adopted by Council.

Business Notes

Clifford, Ont.

Grain elevator owned by E. Tolton destroyed by fire. Loss to building $2,000, little insurance.

Montreal, Que.

Sheds, 2239 St. Hubert St., owned by L. M. Trembly, 2209 St. Hubert St., destroyed by fire. Loss $12,000.

Pembroke, Ont.

Stores, etc., destroyed by fire, owners, W. A. Hunter & Sons, dry goods and grocery store. Loss on building, $10,000; insurance $4,000. S. N. Hunter, hardware, loss $10,000, covered by insurance, also a number of stores damgaed.

Perth, Ont.

Stable owned by Imperial Hotel destroyed by fire. Loss $10,000, partly covered by insurance.

Sturgeon Point, Ont.

Hotel and store owned by Mrs. Fanny Walkey, also boat houses belonging to J. D. & Wm. Flavelle, destroyed by fire.

Truro, N.S.

Hotel owned by Waverley Hotel, destroyed by fire. Loss $6,000, some insurance.

New Companies

The T. Heal Woodworking Co., Ltd., has been incorporated with a capital of $40,000, to carry on business as contractors, carpenters, woodworkers, etc., with head office at Toronto. The provisional directors are W. J. Mitchell, W. S. Thomas and Ernest Constant, brokers, all of Toronto.

Barker Realty Limited, incorporated with a capital of $400,000, to carry on a general contracting and construction business, etc., with head office at Toronto. The provisional directors are Daniel O'Brien, merchant, Mervil MacDonald and Geoffrey Adams, barristers, all of Toronto.

James T. Gilchrist Lumber Co., Ltd., has been incorporated with a capital of $40,000, to carry on a planing mill, woodworking plant and retail lumber business and to deal in builders' supplies with head office at Toronto. The provisional directors are J. T. Gilchrist, lumber merchant, A. S. Winchester and J. W. Broudy, law student, all of Toronto.

Central Contracting Company Limited, has been incorporated with a capital of $50,000, to carry on business as lumbermen, saw millers, lumber and woodenware manufacturers and contractors in all its branches, with head office at Fort William. The provisional directors are E. R. Wayland, broker, C. E. Smith, contractor, and Dr. J. D. Chisholm, all of Fort William.

Upper St. Lawrence Power Company, Limited, has been incorporated with a capital stock of $3,000,000, with head office at Toronto. The incorporators are Wm. Bain, bookkeeper, Robt. Gowans, J. J. Dashwood, clerks, and J. S. Lovell, accountant, all of Toronto.

North American Development & Construction Co., Ltd., has been incorporated

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

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Send for our Catalogue of Asphalt Rollers and Mixers.

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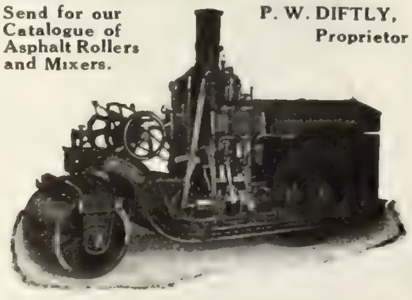

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1303 Peach Street, - Erie, Pa.

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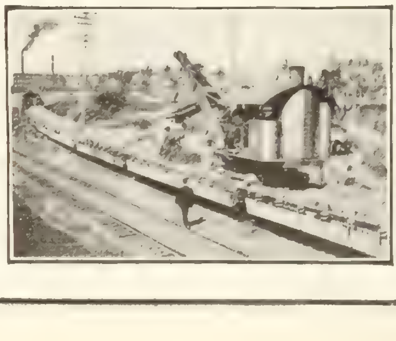

saving their owners Time. Labor and Demurrage are illustrated in our latest Catalog. Write for one at once to

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Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

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Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

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"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

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14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

ated with a capital stock of $100,000, to carry on business as engineers, to operate hydraulic plants, hydro electric plants, reservoirs, waterworks, etc., with head office at Winnipeg. The incorporators are W. J. W. Bullock, engineer, E. J. H. Gifford, real estate agent, and H. DeA. Gill, law student, of Winnipeg.

Late News Items

Edgely, Sask.

Barn, cost $9,000, for Mrs. A. K. Larsen. General contractor, J. Inglis, 1305 Montague St., Regina. 84 x 118, electric lighting. Foundations in.

Guelph, Ont.

W. A. Mahoney, architect, has let contract for new hockey rink for O. A. College, Guelph, to Mr. C. L. Forler, of Phillipsburg. Work to be commenced at once and building rushed to completion.

Hamilton, Ont.

National Natural Gas Co. will lay 7½ miles gas mains between now and January 1st, 1915. Secretary, R. F. Miller, Bank of Hamilton Building.

Store, cost $3,000, for A. R. Campaigne, 401 Barton St. E. General contractor, J. Vogan, 280 Sanford Ave. N. Two storeys, brick construction, concrete foundation, electric lighting, felt and gravel roofing, store front and fixtures.

Addition to factory, cost $3,500, for F. W. Bird & Son, Beach Rd. General contractors, J. Poag & Son, Westinghouse Ave. One storey, frame construction, pariod roofing.

Montreal, Que.

Store house, cost $30,815, planned by Board of Commissioners. Secretary, L. N. Senecal. Plans being prepared by Mr. Barlow, Supt. Waterworks Dept., and will be submitted to Board.

Church, cost $30,000, Pius IX., for Hochelaga Methodists. Rev. Isaac Nosworthy, 814 New Birks Bldg. Plans are being prepared but tenders will probably not be called till spring. 30 x 60.

24 tenements, cost $30,000, Notre Dame des Grace (Western Ave.), for G. N. Clarmont, 97 St. James St. Architect, J. A. Ouellette, 250 Amherst St. Brick, M. Caille, c/o architect. Mason, S. Paulhus, 15 St. Lawrence. Tenders open for all other trades, to close with architect October 18th. Excavating done.

Warehouse, cost $3,825, Cabot, for Montreal Blanket Co., 1600 St. Patrick. Three storeys, 75 x 50, concrete foundation, felt and gravel roofing. Plans ready.

St. Catharines, Ont.

Welland Canal, cost $10,000,000, planned by Dom. Govt., Dept. of Railways & Canals. Secretary, L. K. Jones, Ottawa. General contractor, M. J. O'Brien & H. Doughney, Imperial Bank Bldg., Montreal and Thorold, Ont. Sub-contractors, Quinlan & Robertson, Galt Ave., Montreal, and Thorold, Ont. General contractor has section No.3. Work started.

St. John, N.B.

Walks, etc., planned by City Council. Harbor Commissioner, H. B. Schofield. Tenders to be called shortly for 13,000 ft. spruce deals No. 7, to relay sidewalk on Union St. W. between docks No. 4 and 5, and to repair platform approaching west side toll house, 100 piling, 45 x 55 ft. in length, 100 piling 55 to 65 ft. in length, also for repairs to east and west side piling.

St. Stephen, N.B.

Shoe factory planned. Mayor, Mr. Dinsmore. Inspector of Construction, David Johnston. General contractor, Thos. Toal. Foundations in.

Sarnia, Ont.

Waterworks and sewer system, cost $16,000, planned by City Council. Mayor, Dr. Bell. Ratepayers will vote on bylaw October 24th.

Tillsonburg, Ont.

W. A. Mahoney, architect, Guelph, is getting up plans for a Carnegie Free Library at Tillsonburg. Plans have been approved of by Mr. Carnegie. Tenders will be called for shortly.

Toronto, Ont.

Apartment, cost $6,000, Harrison St. Owner and general contractor, W. S. Grimshaw, 462 Avenue Rd. Two stys., 32 x 47, brick and steel construction, stone foundation, felt and gravel roofing.

Vancouver, B.C.

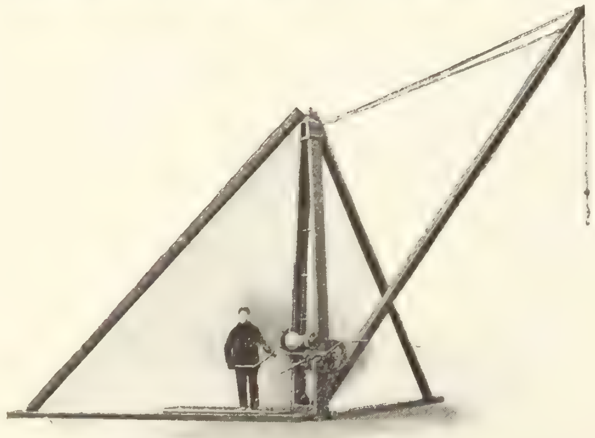
Warehouse, cost $7,000, 2034 11th St., planned by Alaska Bedding Co., 2064 11th St. W. Warehouse, boiler room and laundry. Plans ready.

Windsor, Ont.

Bungalow, cost $6,000, Ouellette, for F. E. Harvey, c/o Cadwell Sand and Gravel Co. Tenders received by Architects, Leybourne & Whitney, from Oct. 20th until 31st. 1½ storeys, 30 x 47, brick construction, cement foundation.

Beath Scotch Derricks

Hand or Power



THE construction of Beath Scotch Derricks embodies several points of merit not found in other makes.

All stress parts are **steel** not cast iron. Bottom Pintle Bearing is of ball and socket type and works in a bath of oil, thus ensuring an easy movement at this joint.

Beath Derricks are provided with self-oiling bearings, ensuring easy operation and reducing wear to a minimum.

We also make Jinniwink Derricks, Stiff Leg Derricks, Guy Derricks, and Steel Derricks for heavy service. Hand or Power operated.

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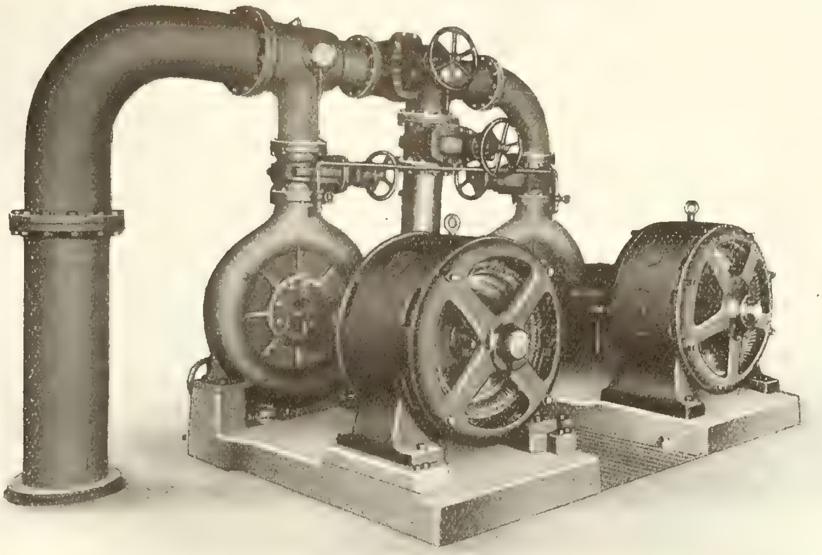

Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

"THE BROWNHOIST LOCOMOTIVE CRANE gives perfect satisfaction"

says the owner of the crane shown here. This crane is being used with a 2 yd. Brownhoist Patent Grab Bucket for handling sand, gravel, and crushed stone from and to cars, stock-pile and wagons.

Do you handle any material?

If so, write for catalog K which shows how and where the Brownhoist Locomotive crane and bucket are used.

THE BROWN HOISTING MACHINERY CO.
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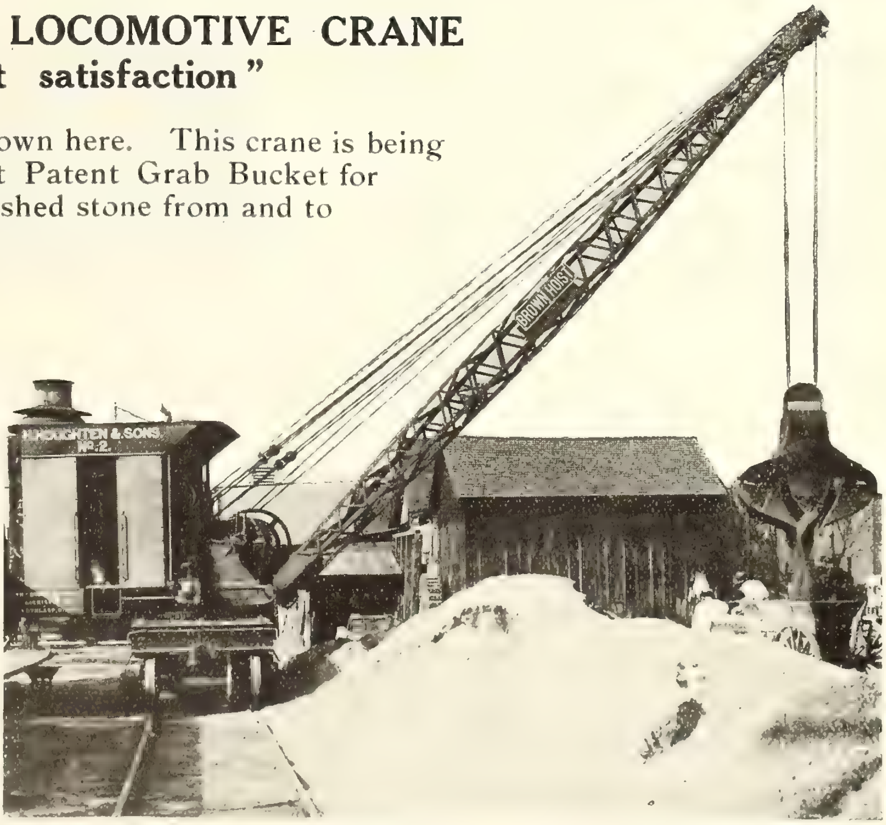
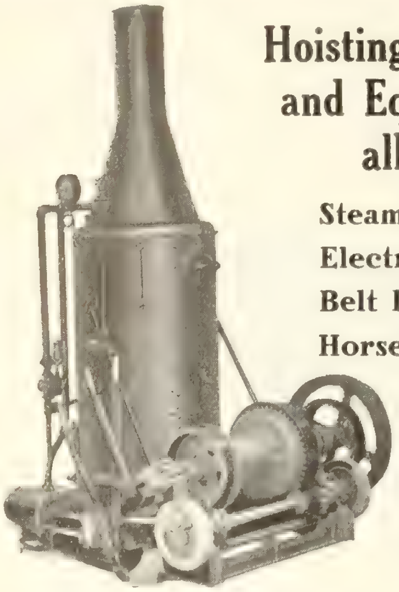
New York	**Chicago**
Pittsburgh	**San Francisco**

The Colby Engineering Co.
Portland, Ore.



Note that the bucket is opened only so far and no sand is spilling over the sides of the wagon. This fine operation is obtained with all Brownhoist Locomotive Cranes and bucket.



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Steel work of all kinds a specialty.

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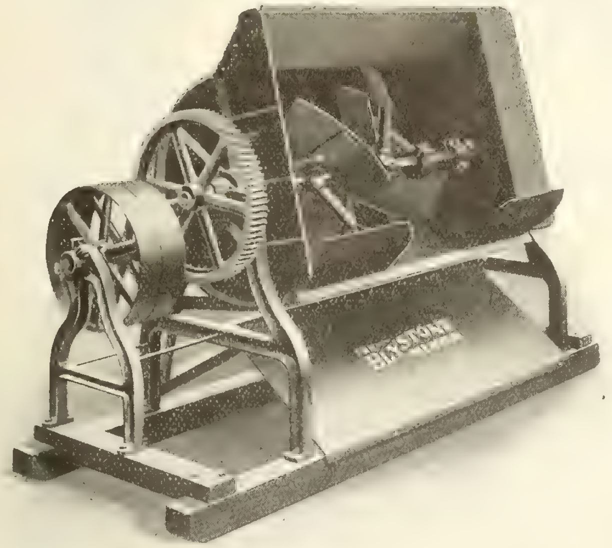

The Blystone Skid Mixer

The perfect design and construction of this mixer reduces the working cost to a minimum and effects the greatest ease in operation. All working parts are strongly made and will not get out of order.

Easy to work—Easy to Clean High efficiency—Low cost

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Full line of Blystone Mixers carried in stock by

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Ceilings

in our beautiful patterns, embossed in steel sheets, improve stores, halls, homes and public buildings. They are durable easy to clean, and prevent the spread of fire.

Install a "Metallic" Ceiling and walls in your store or office, and the attractive result will certainly help you to develop many profitable sales. Write to-day for our illustrated catalogue on "Metallic" Ceilings and Walls.

THE METALLIC ROOFING CO.
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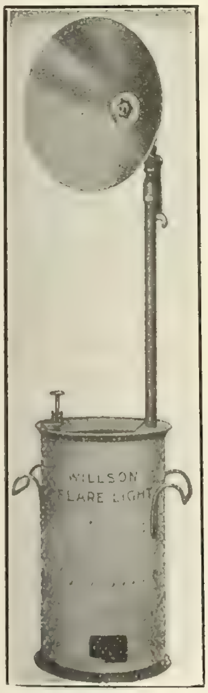
TORONTO AND WINNIPEG

Contractors' Acetylene Flare Lights



Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

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1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

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1—40 H.P. Stationary Boiler and Engine
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2—60 H.P. Tubular Boilers
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1—2 Yard Ore Car
1—1/2 Yard Milwaukee Concrete Mixer (New)
1—30 H.P. D.D. Electric Hoist
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1—No. 5 Pulsometer Pump (New)
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Built of the popular Hamilton Red Pressed Brick

Popular, because its deep uniform red shade is always the same and never fades.

Hamilton Pressed Brick is made from shale, rich in ironoxide and free from so called soda.

It has been used in many of the leading public buildings, schools and residences throughout Canada.

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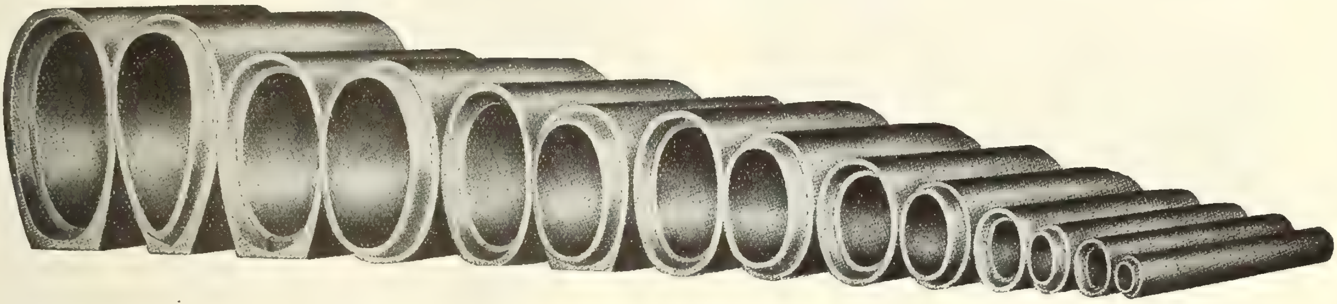

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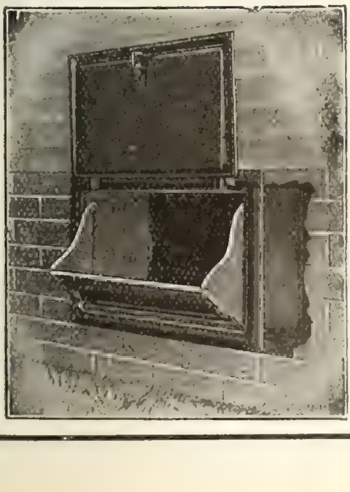

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar.. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

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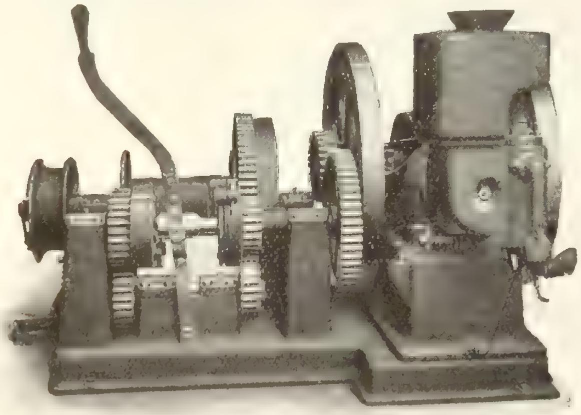
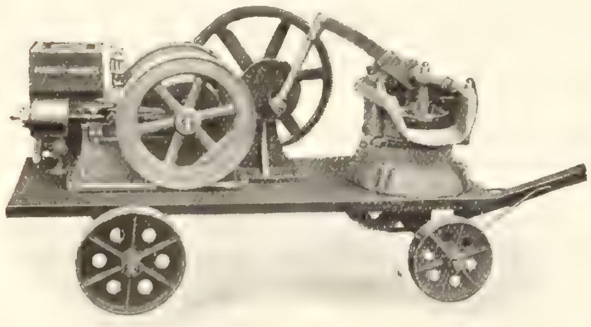
Hoists, Diaphragm Pumps, Plows, Dump Wagons, Dump Carts, Dump Boxes, Heavy Teaming Gears, Gasoline Engines, Etc.



Massey-Harris Direct Connected Hoist has powerful Double Gearing; Band Brake; Adjustable Band Clutches, and in every respect will be found all that a good reliable Hoist should be. Several sizes and styles to suit different requirements.

Massey-Harris Diaphragm Suction Pump. Consists of one of the well-known Massey-Harris Gasoline Engines and a "Goulds" Pump mounted on a convenient hand truck. Both Engine and Pump are the best that can be produced. Full particulars on request.



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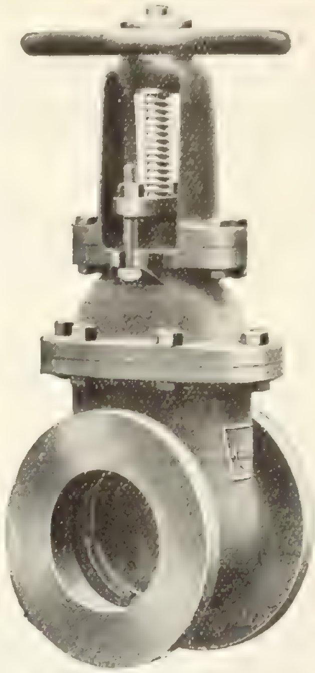

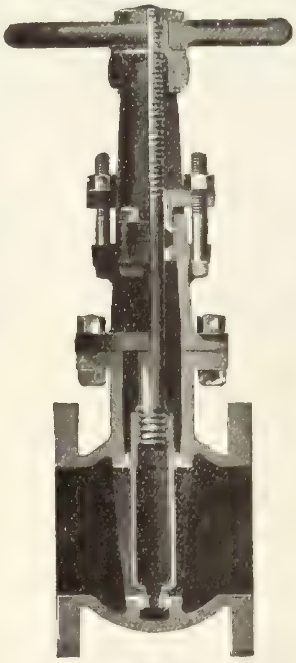

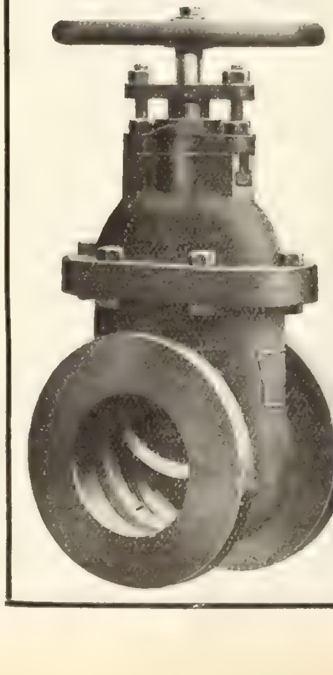

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are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

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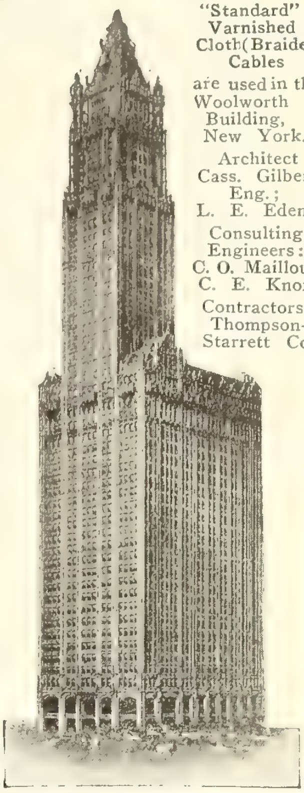

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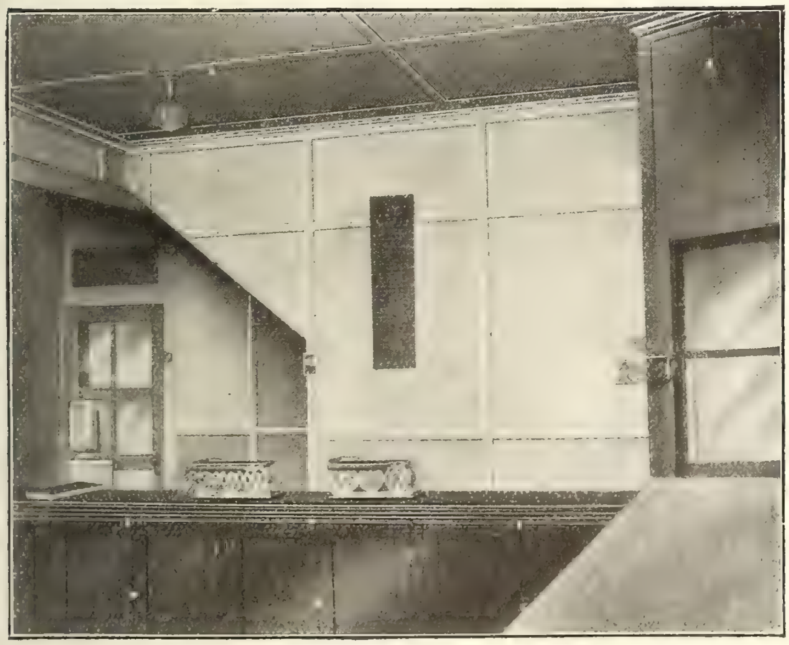

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Linabestos is usually panelled with strips of the same material, as shown in the illustration, or covered with a thin skim coat of plaster. It makes walls and ceilings that are not only fireproof but also warm in winter, cool in summer, easily decorated and practically everlasting.

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INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
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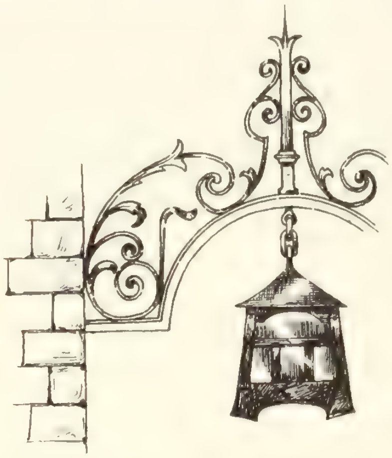

We make and design
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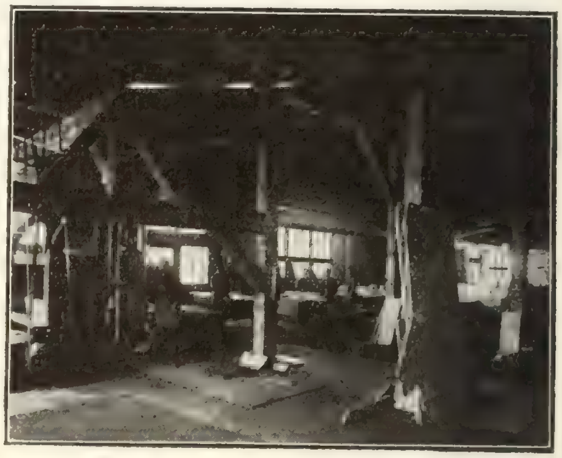

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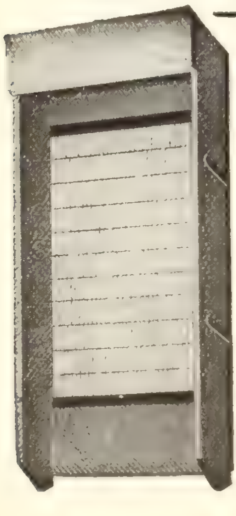
SOLE producers of the Beautiful Royal Dominion marble quarried at South Stukely, Que. A card or 'phone call will bring our representative to submit figures on any class of marble work. Address all letters to the Company P.O. Box 1166, Montreal.



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SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

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For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.
The benefit of 20 years experience as successful contractors.

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OUR PLANT has a capacity of 40,000 bricks per day.
It has excellent delivery facilities.
It is the most modern plant in the city.

OUR BRICK are carefully made under expert supervision. They are fireproof.
They absorb from 10% to 12% less moisture than ordinary clay brick.
Their crushing strength, 3030 lbs. per sq.in. by actual School of Science test, is far greater than ordinary stock brick.
They are the same size as standard stock brick.
They do not break so easily as clay brick and the percentage of bats and culls is very low.
They are uniform in color, size and quality.
The older they are, the harder they get.
They give the most value for the least money.

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HERE is a brand of hard wall plaster that is always ready for immediate use.

It saves from four to eight weeks' time in completing your building because it sets quickly.

Costs less than lime.

Anchor Plaster sets hard as rock and will never come down. Use it for your next job.

Alabastine Hardmortar, Ltd.

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Prompt Shipment

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Lime, Stone, Cement, Sewer Pipe, Fire Brick, Weeping Tile, Mortar Colors, Plaster, &c.

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Deliveries—G.T.R. and C.P.R.

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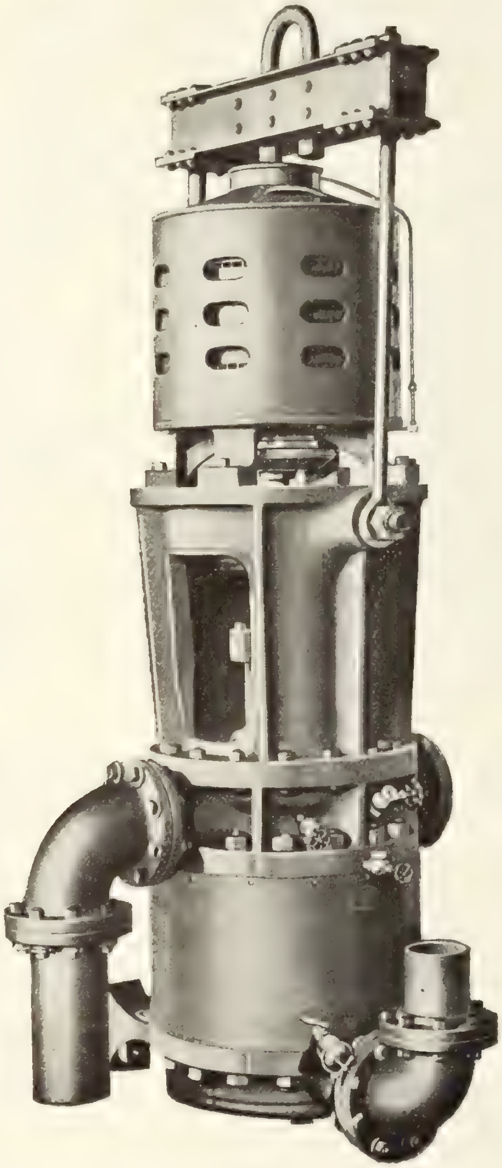
FOR GENERAL CONTRACTING PURPOSES



MOTOR DRIVEN SINKING PUMP
250 Imp. gals. per min. 1800 r.p.m. 300 ft. head.

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"BEATTY" HOISTS

Contractors who buy numbers of Hoists usually have to be convinced that what they are getting is "O. K."

The closer they examine and watch Beatty Hoists under severest conditions — the better pleased they are.

Their use spells Satisfaction.

The reason? The material, design and workmanship "are there."

We are building for the future—both yours and our own.

If you place one Beatty Hoist on your work, you'll eventually buy more.

Will gladly send full particulars and catalog.

Dipper Dredges
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For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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Roof Trusses—Turntables
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of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, New Glasgow, N. S.

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Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

SAND & SUPPLIES, LIMITED

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Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

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CAST IRON PIPE

Head Office:
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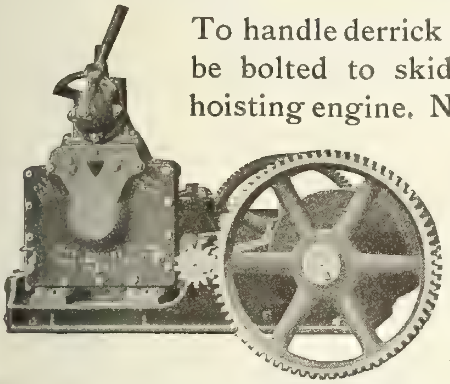
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.



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To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

Start, Stop, Reverse at Will

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"Queenston Blue" Limestone

Send us your specifications for Cut Stone work

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for Interior Construction

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Sole Manufacturers under Canadian and U. S. Letters Patent
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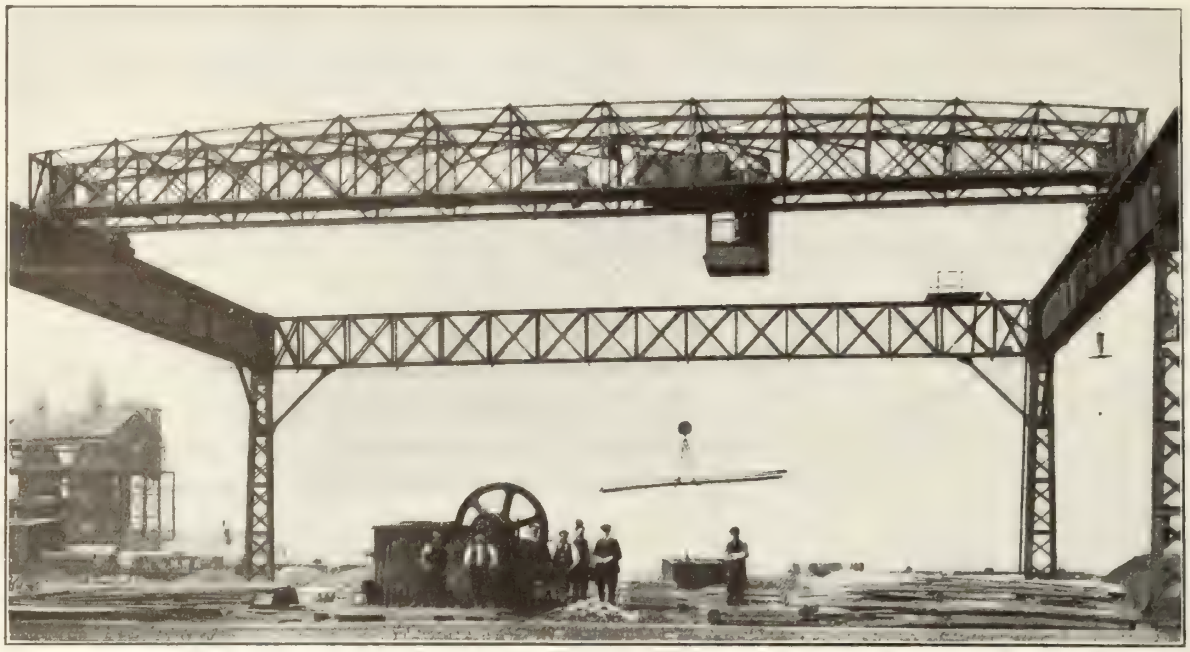
every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments Offices, Works and Docks, TORONTO



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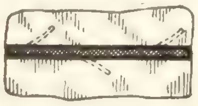
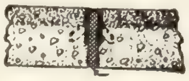
Send for This Book on Concrete Pavements

Our booklet on concrete pavements illustrates and describes pavements in many different cities, giving cost data and describing in detail the methods used. Complete specifications for the ideal concrete pavements are included as well as instructions for installing Baker plates. This booklet is sent without charge to responsible engineers contractors and highway officials.



Longitudinal Section Showing Joint.



Cross-Section of Pavement Showing Expansion Joint.

Baker Armor Plates

Protect Your Concrete Pavement at its Weakest Point—the Expansion Joint

Wayne County's 70 Miles of Concrete Roads Prove that the Baker Plate Has Solved the Expansion Joint Problem.

"The only surface repair required on our concrete roads has been on the roads first constructed, where the joints were not protected with the 'armor' plates."

Extract from Sixth Annual Report of the Board of Country Road Commissioners, of Wayne County, Mich., Sept. 30th, 1912.

Our new system of installing Baker Armor Plates is simplicity itself, and holds the joint to perfect line and grade.

We guarantee Baker Armor Plates to be perfectly crowned as specified, and entirely free from defects of manufacture.

R. D. BAKER CO., 73 Home Bank Bldg.
DETROIT, - MICH.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

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Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.

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Steel Structures

to support them.

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Estimates furnished promptly. Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
Main Office and Works, Montreal

Engines and Boilers

of all types and sizes, Heaters, Tanks, Pumps, etc.

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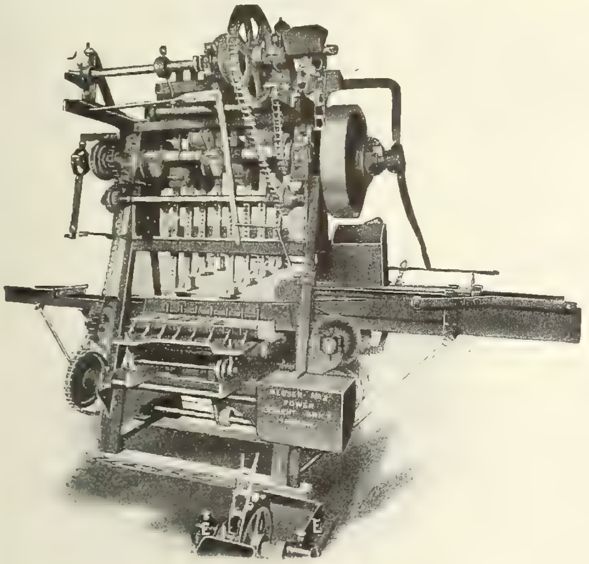
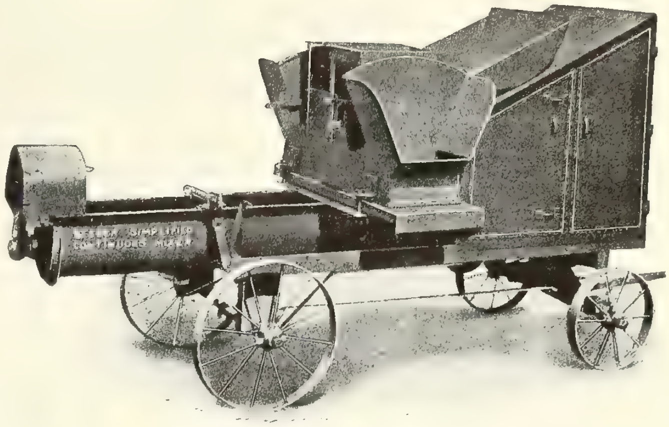
Cement Bricks

Here are the two Besser machines that make the best cement brick on the market. The Brick machine that will make 30,000 bricks per day—every brick the same.



Besser Power Cement Brick Machine

Woodstock Wind-Motor Co., Ltd.
WOODSTOCK, ONTARIO



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STONE of any Size and in any Quantity on hand for Sidewalks, Roadwork or Concrete Work

Works:
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Phone Main 4316

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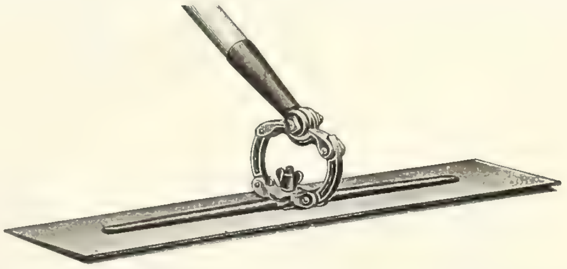
G. W. ESSERY, Manager



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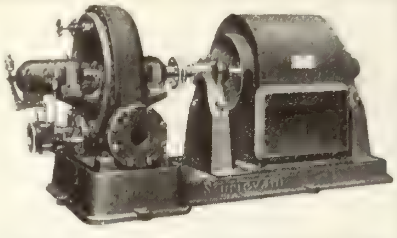

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Sturtevant Turbo Blower for Forced Draft Work

STURTEVANT Steam Turbines are simple, reliable, and always ready. They show exceptionally low steam consumptions in actual operation. They are especially adapted for driving fans, centrifugal pumps, and electric generators. Used by the New York Edison Company, the Indiana Steel Company, and other large corporations after thorough investigation of all competing machines.

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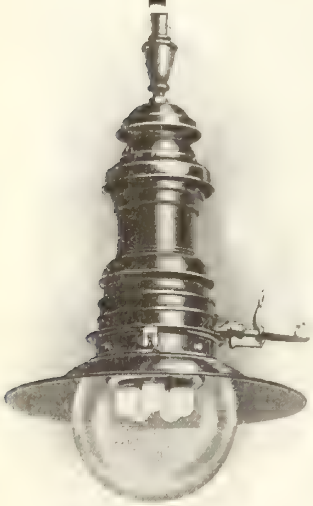
DECARIE INCINERATOR CO
MINNEAPOLIS MINNESOTA



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BECAUSE IT GETS ATTENTION

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The Consumers' Gas Co.
12-14 Adelaide St. West Telephone Main 1993

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Gibbs & Canning, Limited
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Works established over half a Century.
All Colors with plain or dragged surface or with Matt Glaze.
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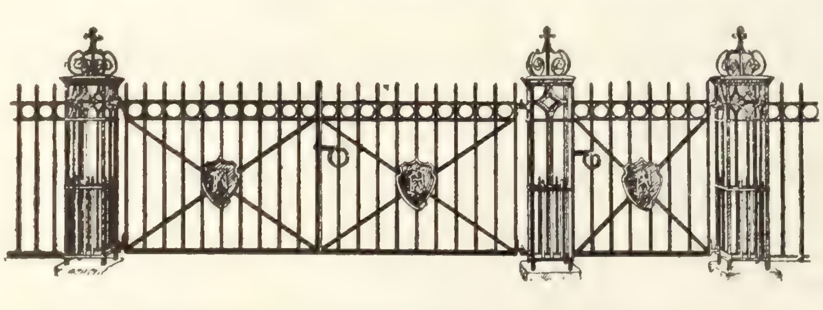
WINNIPEG
Barker & North, 26 Princess Street

Iron Fence and Grill Work



If you have any special designs, monogram plates or particular work in ornamental iron, you can depend upon us to faithfully fashion your designs.

Prices and Particulars cheerfully furnished.

WE ALSO DO IRON STAIR WORK

The Geo. B. Meadows
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TORONTO, - ONT.
MEADOWS' BLOCK, WELLINGTON ST. WEST

Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915 **Factory: 550 Pacific St., VANCOUVER, B. C.**

The Maple Leaf Elevators, Port Colborne. J. H. Tromanhauser, General Contractor.
80,000 sq. ft. Barrett Specification Roofing on this building.

This building is but one of the many large contracts executed by us.
Our years of experience and large equipment are such as to enable us to handle these large contracts with promptness.
We can include for any specification along the lines of a Built-up Roof, Dampproofing foundations, sub-floors, etc.
Kalameined and Tin Clad Fire Doors, Skylights, Cornice and all Sheet Metal Work.
Send along your plans and specifications at our expense, we will quote you a close price and return them promptly.

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Roofing and Sheet Metal Contractors

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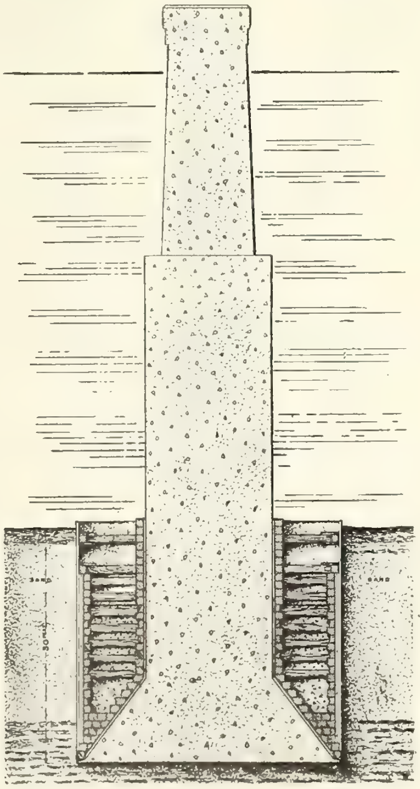

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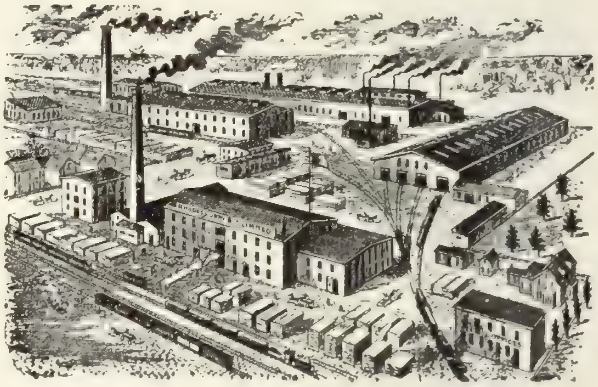

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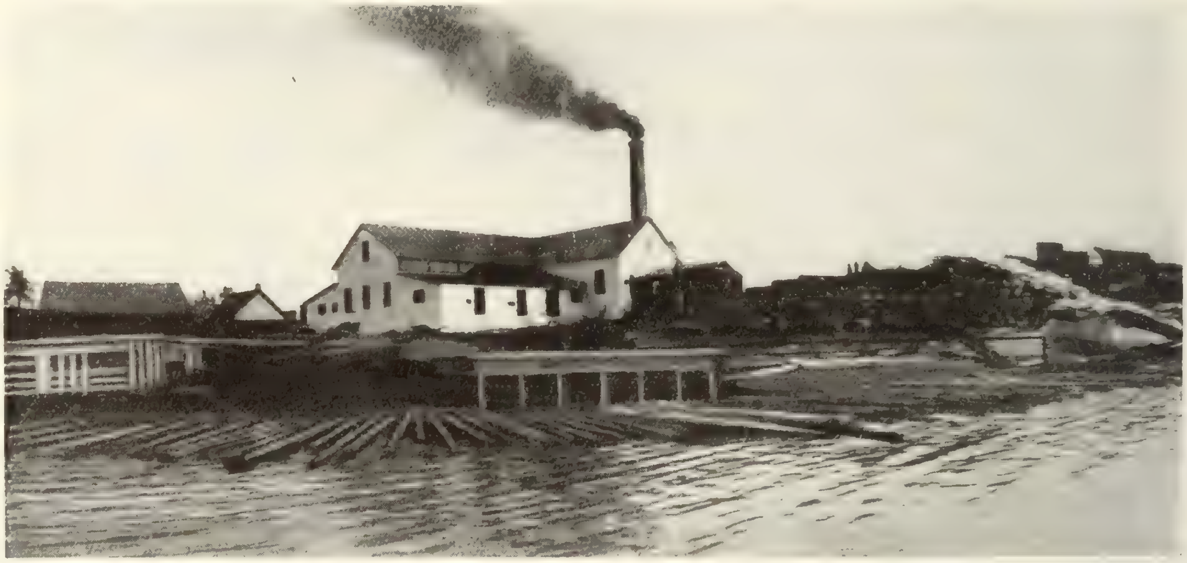

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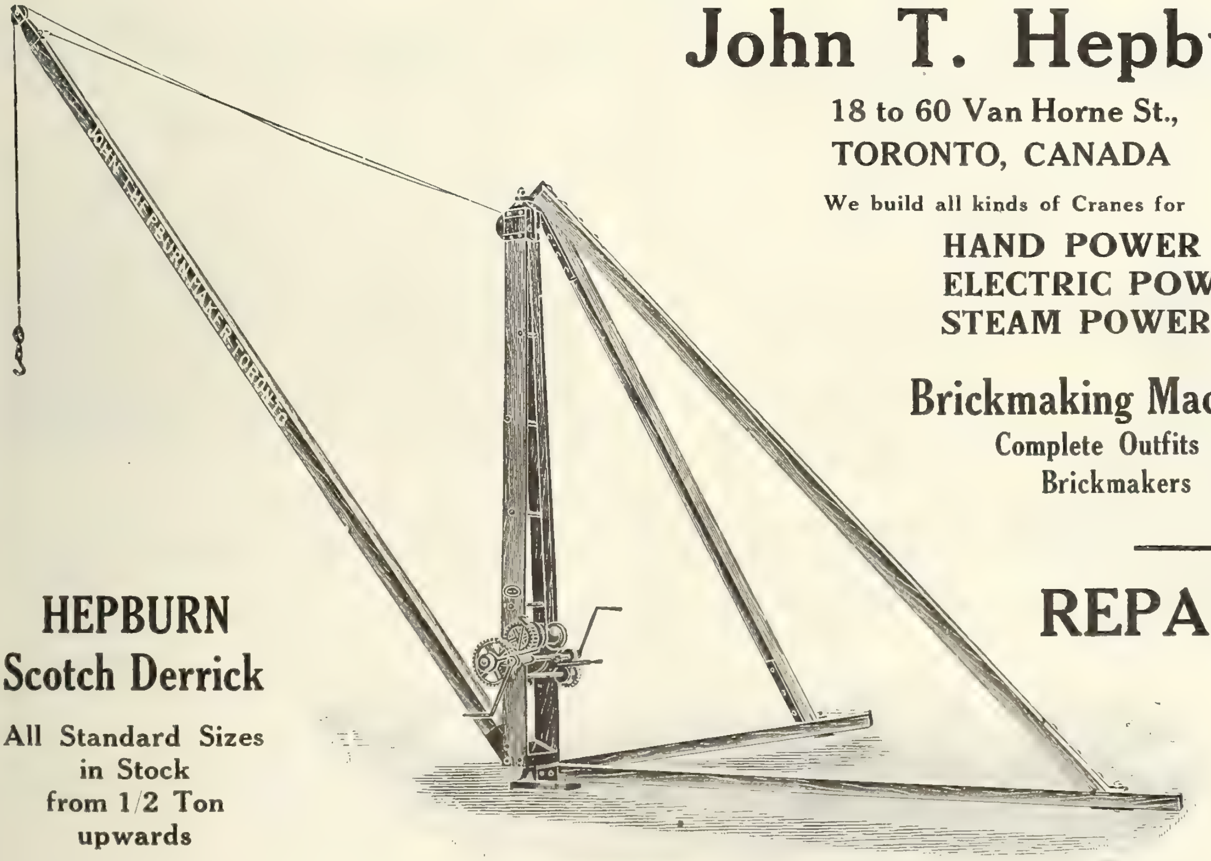
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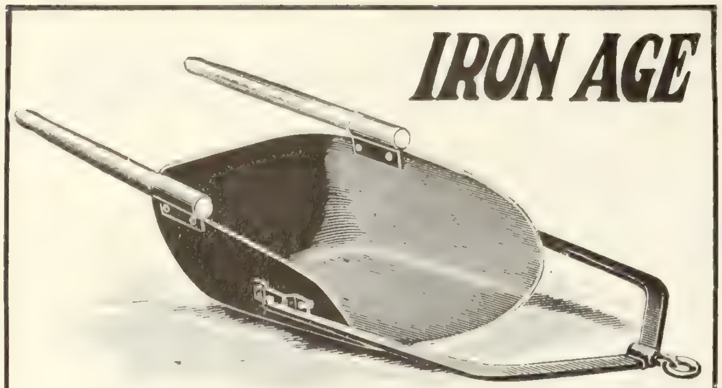

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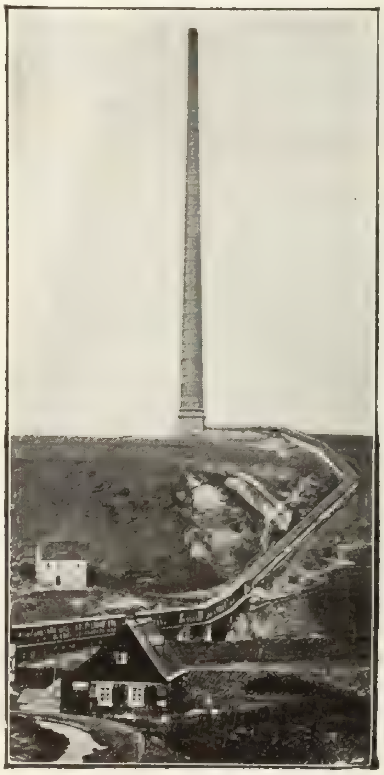

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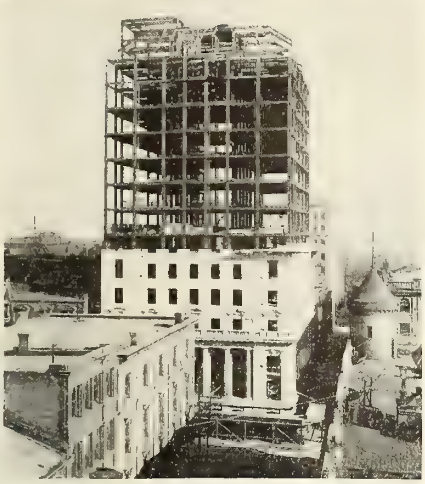

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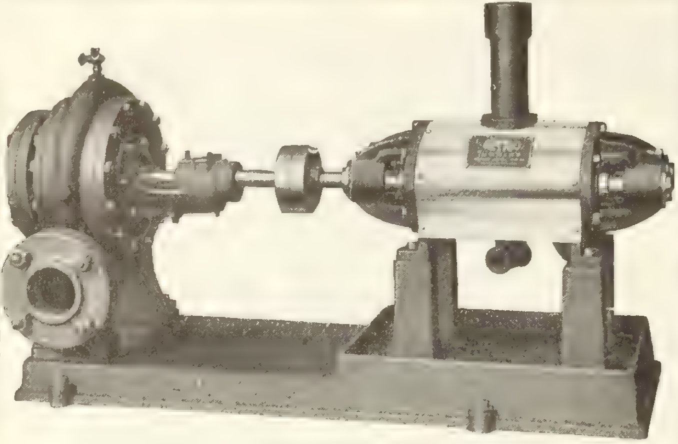

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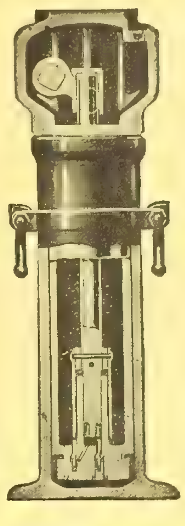

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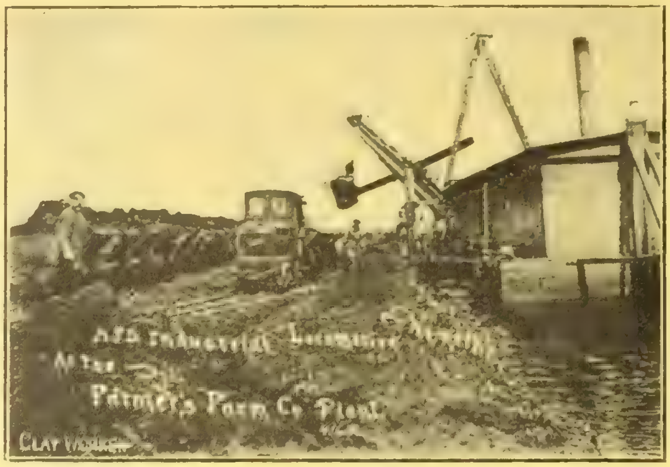

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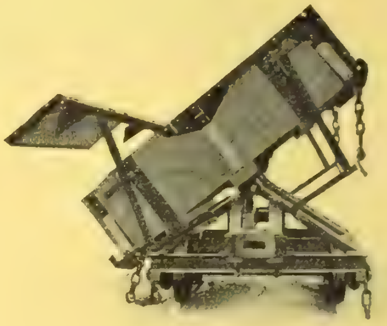
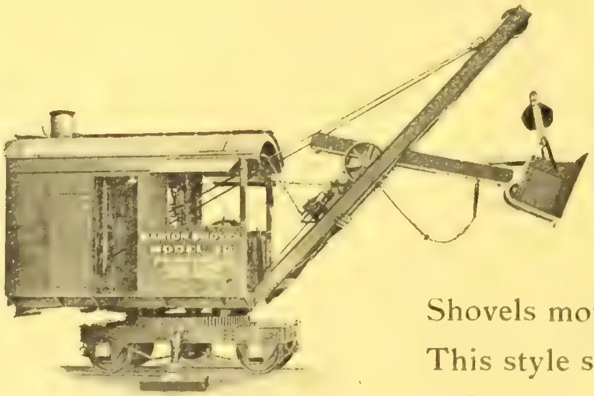
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.





"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
5 8 - 1 and 1 1 2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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Vol. 27 Toronto, October 22, 1913 No. 43

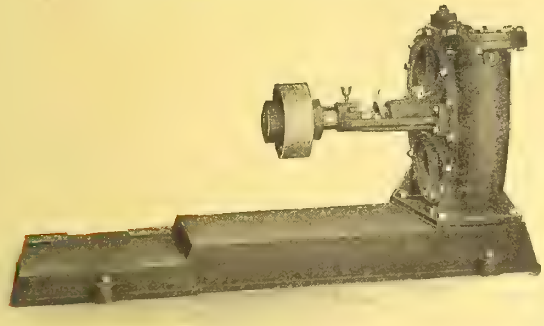
ESTABLISHED 1886

Contract Record and Engineering Review

We manufacture all kinds of

Steam and Power Pumps

for all kinds of service, using only the best material and workmanship.



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Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
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Head Office and Works: 91 to 133 Don Roadway
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Air Compressors
OF BELLISS MAKE
have gained their reputation for

Simplicity of Design
Noiseless Running
Compact Design
Low Oil Consumption
Continuous Operation
Overall Efficiency

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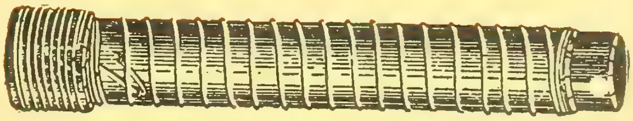


Continuous and Machine Banded Wood Stave

WATER PIPE

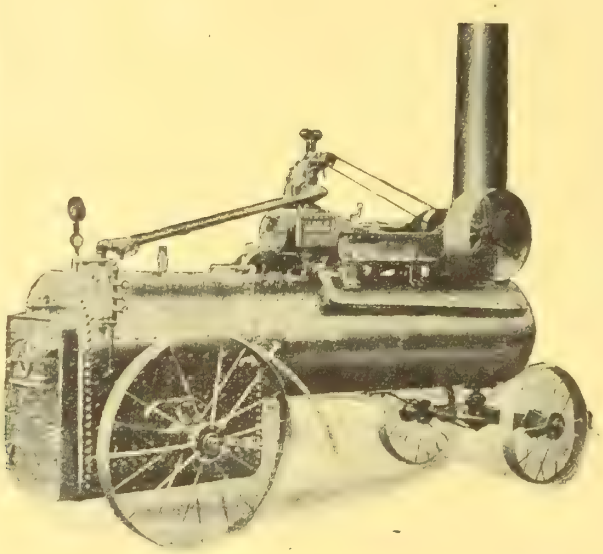
RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6

PORTABLE POWER PLANTS



THE cut shows one of our compact and *portable* power plants for driving Crusher Outfits, etc. A complete power plant in itself—durable and efficient. We build different sizes and can meet your requirements precisely.

The Jenckes Machine Co.
Limited

General Offices:—Sherbrooke, Que.
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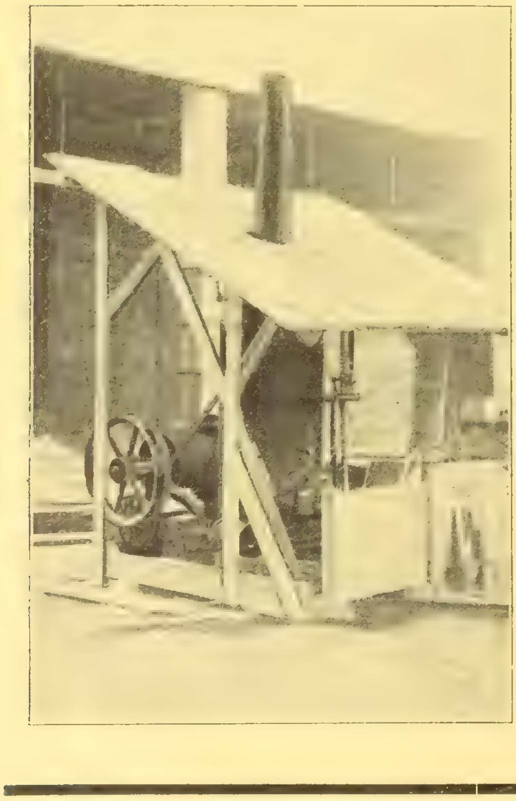

This "AMERICAN" Engine Has Been On The Job Steadily For 20 Years And it is Still There.

In 1893 it won a Blue Ribbon at the Chicago World's Fair and ever since it has been busy demonstrating that the honor was well deserved.

For almost a quarter of a century it has been helping its owner, a southern contractor, finish his jobs ahead of time and to-day it looks fully capable of keeping up the good work for twenty years more.

That's a pretty good record of efficiency, durability and economy. It's the kind of a record "AMERICAN" Engines are making every day everywhere.

Made by

AMERICAN HOIST & DERRICK COMPANY
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Gorman, Clancey & Grindley, Edmonton and Calgary, Alta., and Nelson, B.C.

CANADA Portland CEMENT

SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
PORTLAND
CANADA
CEMENT
MONTREAL

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

Canada Cement Company, Limited

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Marsh & Henthorn

Hoisting Engines

are known for their standing-up ability. Material and workmanship entering into their construction are guaranteed.

Sizes 10 to 50 H. P.

Standard Sizes Carried in Stock.

Special Sizes Made to Order.

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BELT
ELECTRIC
DRIVEN

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Fall in Line With Modern Contractors!

HERE'S THE WAY

TIME was when concrete was mixed by hand. Today every contractor has a concrete mixer in his outfit. Formerly materials were hoisted by hand with an "A" frame and blocks and tackle. Today a contractor uses one or more hoisting engines on every job.

Contractors all over the country are now adding Portable and Stationary Rock Crushers to their outfits. It's an important part of their equipment. Time and time again he who has a crusher has the advantage over his fellow contractor. You know of many a job that could have been landed if materials could have been secured on short notice. A contractor with a

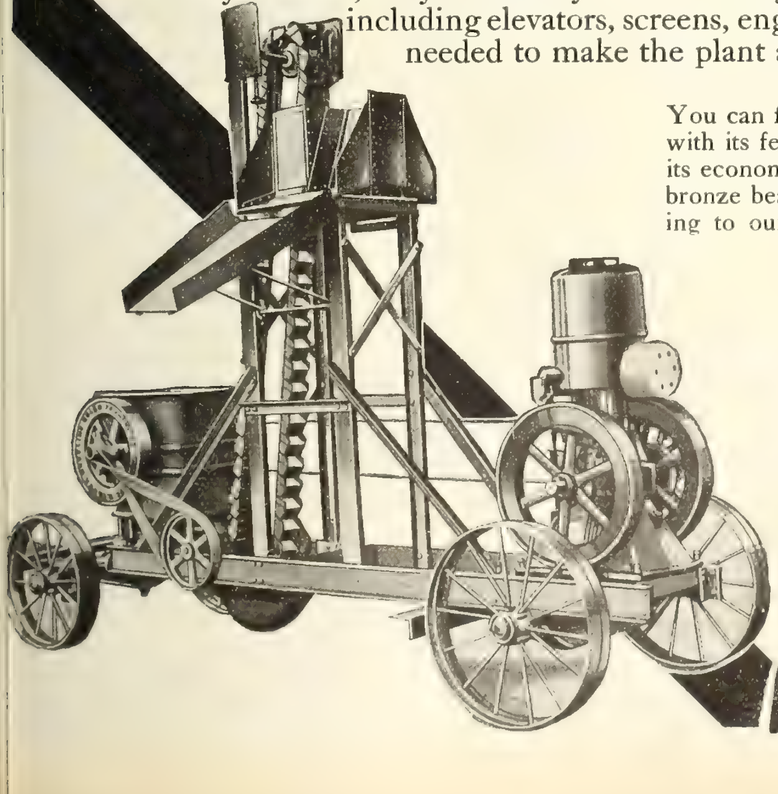
Wheeling *FORCED FEED* Crusher

Can start his work at once! He does not have to wait for stone and gravel to be shipped in.

You can never tell when a rush job will catch you short of stone. Wouldn't a small crusher, say a Motor Crusher outfit, like the one illustrated, with gasoline or steam engine mounted on trucks with elevator, and screen, be a handy thing to have? Since the cost would be no more than for a good mixer, wouldn't the investment pay? Just thirty days' use at the right time might mean a saving of several thousand dollars.

No proposition requiring the crushing of stone (whether the plant is stationary or portable) is too large for us. We offer you, free of expense, the service of our engineers to point out in any way you suggest, how you can use a Wheeling Crusher to advantage.

If you can't, they will tell you so. Designing and installing complete plants, including elevators, screens, engine and boiler, pulverizer, or whatever is needed to make the plant a producer, is part of our regular work.



You can find out all about this remarkable steel crusher with its feature of adjustment to crush to various sizes, its economy in cost and wear, its replaceable phosphor bronze bearings, as well as the ***service*** we offer by writing to our nearest branch office.

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(Continued on page 12)

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Don Valley Uniformity

The uniformity of size and shade and the unvarying good quality of Don Valley Clay Products has made them the popular material for every class of building.

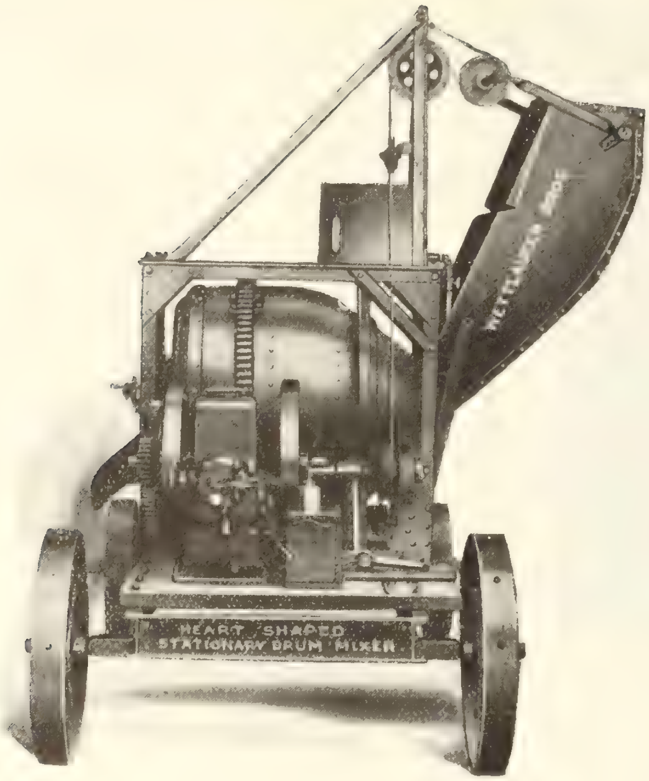
For bank buildings the architectural possibilities of Don Valley Bricks are almost without number. Some pleasing and permanent effects may be obtained by arranging the bricks in patterns or panels.

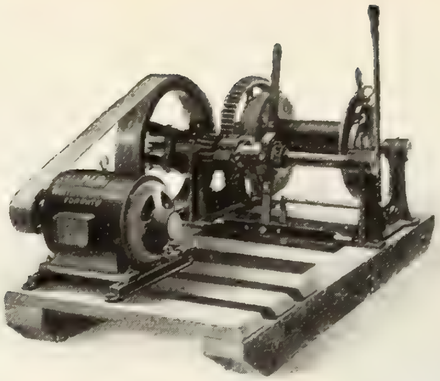
Don Valley Clay Products are specified for Canada's finest buildings.

Use the Best Don Valley

Don Valley Brick Works

Toronto
Ontario





The Famous Wettlaufer Line

For Thorough Mixing

the Wettlaufer Stationary Heartshape Mixer has no equal. The material enters the small conical head of the drum, when, on account of the Heartshape, it immediately forces its way to the back. In addition to this action, fans or mixing blades installed in the drum greatly increase the mixing powers of the machine, by throwing the material very rapidly from end to end, while the batch is retained in the back of the drum ready for instant delivery. Even without fans our Heartshape Drum will thoroughly mix the concrete by reason of its shape alone. The addition of mixing blades renders it the most perfect and fastest mixing drum possible to produce.

Write us for catalogue

Wettlaufer Bros.

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AND CRUSHED STONE

The most dependable for all types of construction and engineering-contracting work — especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, &c.

Rogers' Brands:

PYRAMID DORIC SUPERIOR
STERLING SAUGEEN

Mills at:

KIRKFIELD ST. MARY'S HANOVER
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Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

Concrete Tank at Berlin, Ont.
BUILT WITH ROGERS' CEMENT.
L. J. MENSCH, M. Am. Soc. C.E., CHICAGO, ILL.
Engineer and General Contractor.

Crushed Stone

Our crushed stone is free from dust, dirt and mold—it is really clean stone—properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

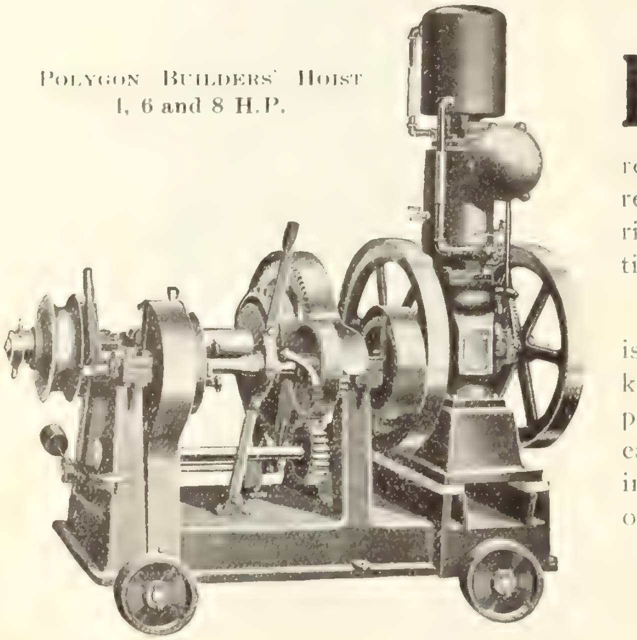
28 King Street West, Toronto

POLYGON

CONCRETE MIXERS

AND

BUILDERS' HOISTS



Polygon Builders' Hoist
4, 6 and 8 H.P.

represent the highest efficiency yet attained in their respective lines. They have demonstrated their superiority through ten years of steadily growing appreciation and large sales all over the world.

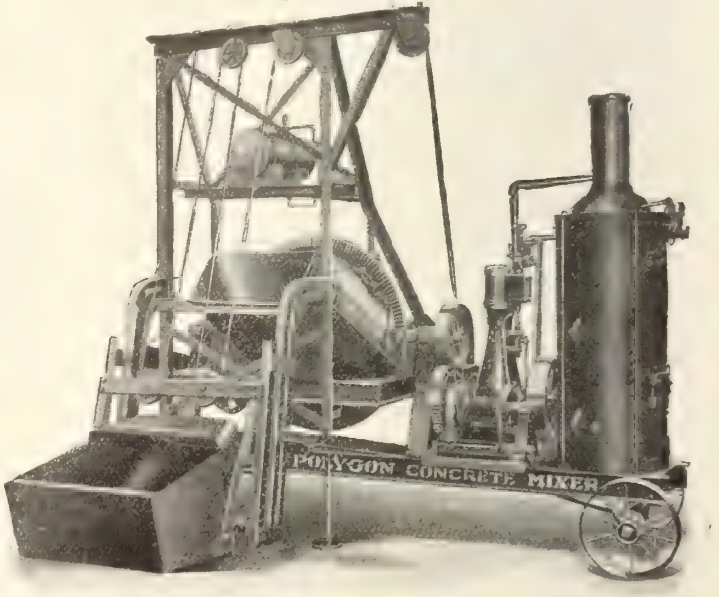
THE POLYGON BUILDERS' HOIST

is a distinctly great advance over all machines of the kind yet designed. Large lifting capacity in ratio to power employed; rigidity, long bearings, covered gears, easy control and other exclusive features warrant examination by all who wish the most efficient hoist to be obtained at moderate price.

The
Polygon Concrete Mixer

has the reputation of being "The Fastest Perfect Mixer." The POLYGON (many sided) form of drum is its distinguishing feature. Once you grasp the POLYGON principle of mixing you will have no other. It mixes concrete, mortar, and other materials, fine or coarse, wet or dry, with equal facility. Size for size the POLYGON will turn out a greater quantity of perfectly mixed concrete than any other mixer.

In all points that make for profit on the job, the POLYGON is the logical choice of all who really investigate. Ask us for full particulars.



Polygon Tilting Drum Steam Outfit with Side Loader
Built in capacities of $7\frac{1}{2}$ to 50 cubic ft. of unmixed material per batch.

WATERLOO CEMENT MACH'Y CORP'N

117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists, Elevators and Cement Tools

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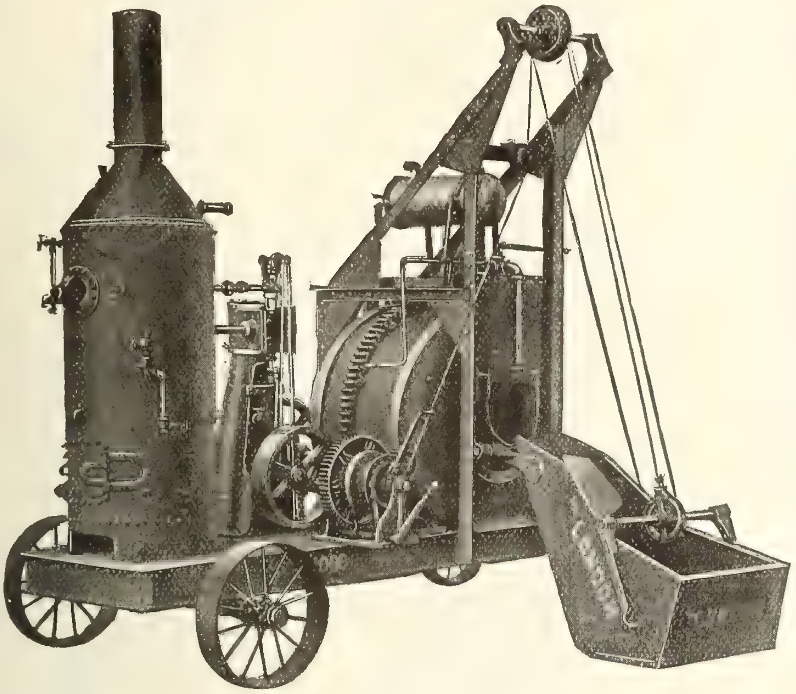
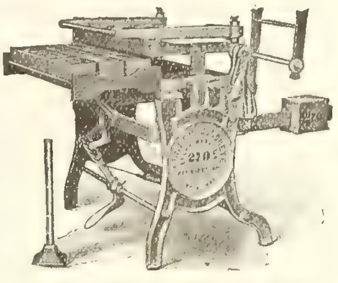


London Standard Drum Batch Mixer

Showing the largest line of Concrete Machinery ever crammed into a Catalogue.

All made in our own Factory and under a system producing an excellence of quality. Our large output right from Factory to the Contractor.



London Cement Brick Machine.

Even such remarkably low prices are preferable to exorbitant prices and small output.

Some people wonder how we can sell high grade machinery at such low prices. **It is quite simple. Our Enormous Sales and Small Profits are sufficient explanation.**

We manufacture over twenty different sizes and styles of **Concrete Mixers, Mortar Mixers, Concrete Block Machines, Cement Brick Machines, Cement Tile Machines, Tile Moulds, Rock Crushers, Screens and Elevators.**

London Cement Block Machine.

- **Gasoline Engines**
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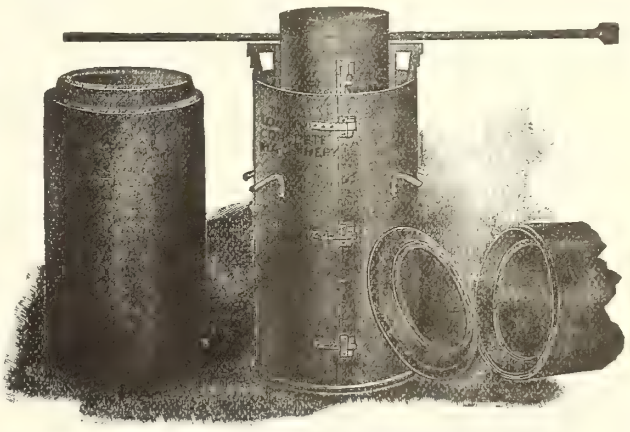

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A Complete Line of Cement Working Tools.

London Concrete Machinery Co., Limited

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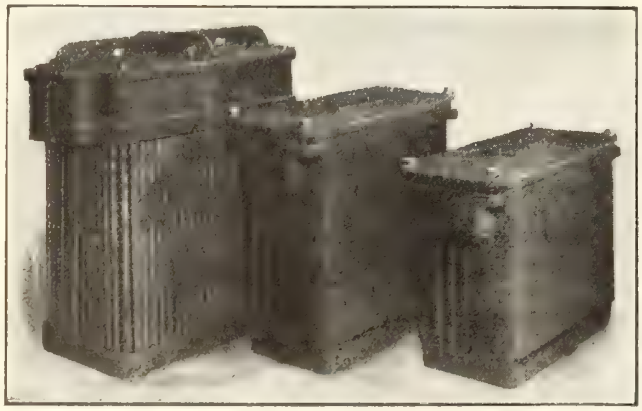
Power Logic

Reduced Loss Increased Profit

Ferranti Transformers



Three Phase Pole or Station Transformers

The Transmission line that is equipped with Ferranti three phase transformers is always a profitable one because of the great reduction in energy-loss made possible by these efficient transformers.

All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

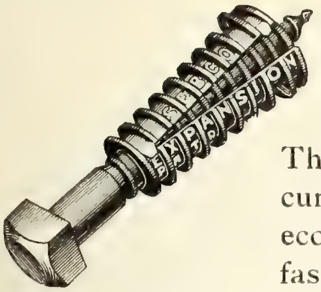
Three phase transformers are the most economical type to operate and will effect a considerable saving in construction cost.

Write us for particulars

The Ferranti Electrical Co., of Canada, Limited

TORONTO
90 Sherbourne St.

WINNIPEG
56 Albert St.



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The quickest, most secure, dependable and economical method of fastening railings, gratings, iron doors and window frames, pipes, shafting and machinery of every description to walls, floors or ceilings of hard substance such as brick, stone and concrete.

A hole is drilled, the SEBCO Shield inserted, which expands as the Bolt is tightened, embedding itself firmly in the material allowing no movement of any kind.

Samples and Catalog free.

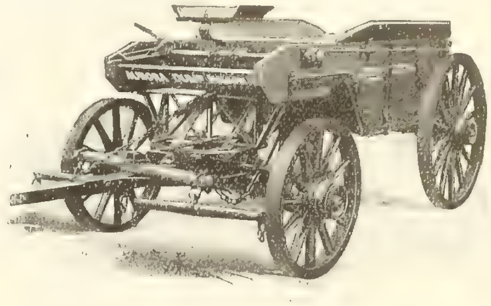
STAR
EXPANSION BOLT
COMPANY
147-149 Cedar Street
New York

SEBCO
Screw Anchors

Are non-rusting. They are used for fastening small fixtures of all kinds to marble, tile, etc.

Looking Into The Future

You don't buy a dump wagon just for today. You'll want to use it **tomorrow** and **next year.** For use next year and years to come, buy today.



Western Dump Wagons

They are reinforced with steel just where the strain comes. Noted for their wonderful strength and lasting qualities.

Here's a few advantages, look them over:

Light Draft, Improved Hinge, Doors Easily Operated, Large Discharge Opening, and many others, all told in our catalog, that is yours for the asking.

Western Wheeled Scraper Co.
Earth and Stone Handling Machinery
Aurora, Illinois

Hagersville Crushed Stone

The Toughest Stone for Macadam in Ontario

Record of Logan Avenue, Toronto, Macadamized from Queen St. to Gerrard St., in 1902

Length 2,454 Lin. Ft. Width 24 Lin. Ft. 6,550 Sq. Yds.

COST FOR REPAIRS

1903	$ 0.00	1908	$ 93.26
1904	3.30	1909	200.46
1905	9.35	1910	14.07
1906	37.33	1911	2.29
1907	16.11		

Total $376.17 or 5⅔c. per sq. yd. for repairs for nine years, a little over 6-10 of 1c. per sq. yd. per year.

Why Not Use Hagersville Stone and Get These Results?

Hagersville Contracting Co.
Hagersville, Ont. Limited

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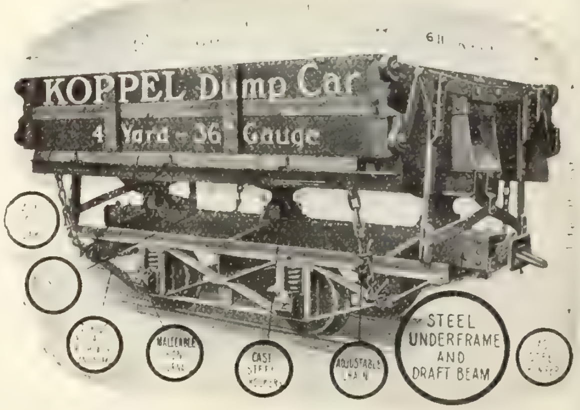

What Big Contractors

Say About This Koppel Car

Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein - Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

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Barrett Specification Roofs

Last Longest—Cost Least

THE proper unit in comparing the values of roofings is the cost-per-foot-per-year-of-service.

To have a low unit cost a roofing must be—

1st. Inexpensive to build,
2d. Inexpensive to maintain, and
3d. Of great durability.

Barrett Specification Roofs are—
1st. The *least* expensive of all permanent roofs to build,
2d. They cost *nothing* to maintain, and
3d. They usually last, without repairs or leaks, *20 years* or over.

The net result of these three factors is a unit cost of about ¼c. per foot per year of service. This is a lower unit cost than ever attained by any other class of roofing.

Accordingly, Barrett Specification Roofs are in almost universal use on buildings such as illustrated herewith, where unit costs are intelligently studied.

Herald Building
Montreal.

Architects—Brown & Vallance, Montreal.
G. C. Nicholson & Co., Montreal.
Roofers—Metal Shingle & Siding Co., Montreal

Copy of the Barrett Specification with tracing ready for incorporation in your building plans sent free on request. Address nearest office.

Special Note

We advise incorporating in plans the full wording of the Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired however, the following is suggested.

ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified and subject to the inspection requirement.

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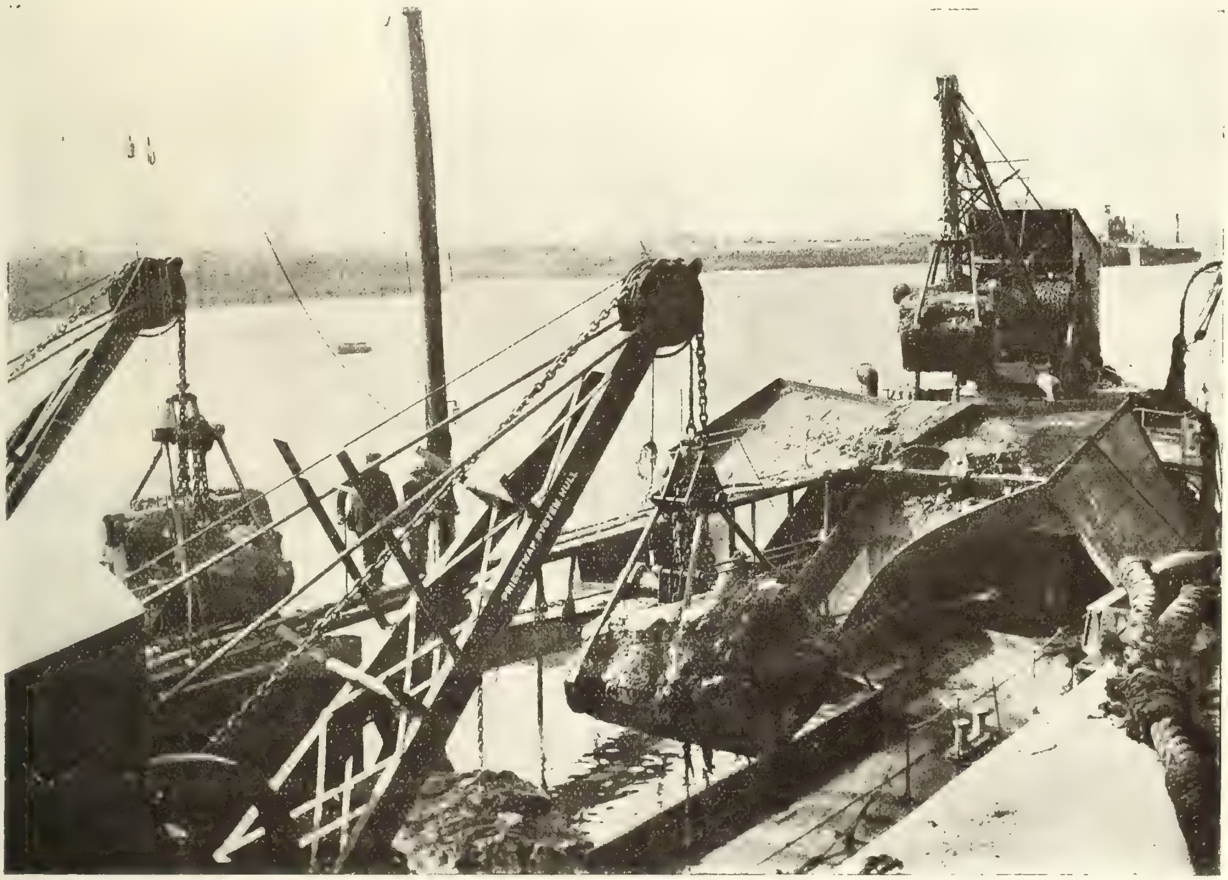

Priestman Dredger at Work

Special Notice to Contractors

Our latest catalogue 123 on Double Chain Grabs is just out and we shall be pleased to send copies on application.

Lecky & Collis, Limited

335 A Craig Street W., Montreal and Napanee, Ontario

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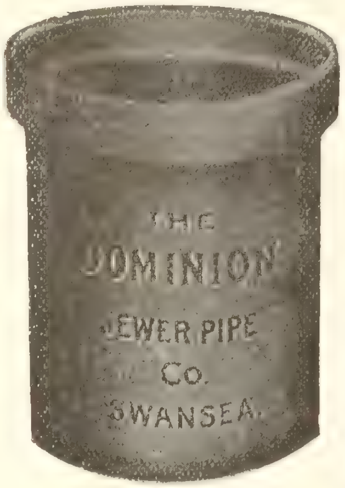
Salt Glazed and Vitrified

SEWER PIPES



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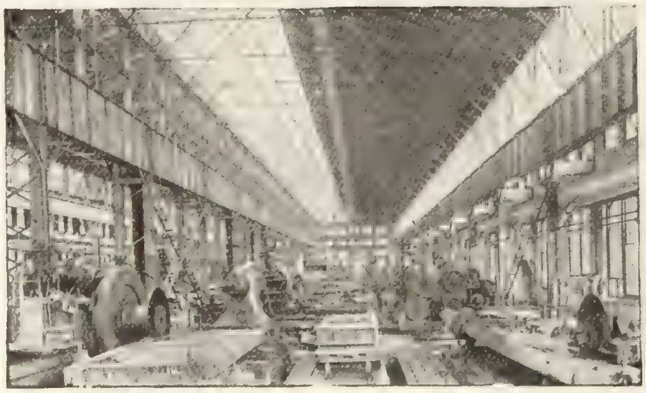

Ordnance Shop No. 4 of the Midvale Steel Co., Nicetown, Penn

This shop has a content of about 5,250,000 cu. ft. It is heated by four apparatus, one in each corner of the building. Each apparatus consists of an 8 x 4 Sturtevant fan driven by 8 x 12 Sturtevant Steam Engine. Each fan operates in connection with Sturtevant Pipe Coil Heater arranged for Exhaust Steam.

The fans discharge the heated air into the galvanized iron duct which runs entirely around the inside walls and delivers the air at intervals through short spouts.

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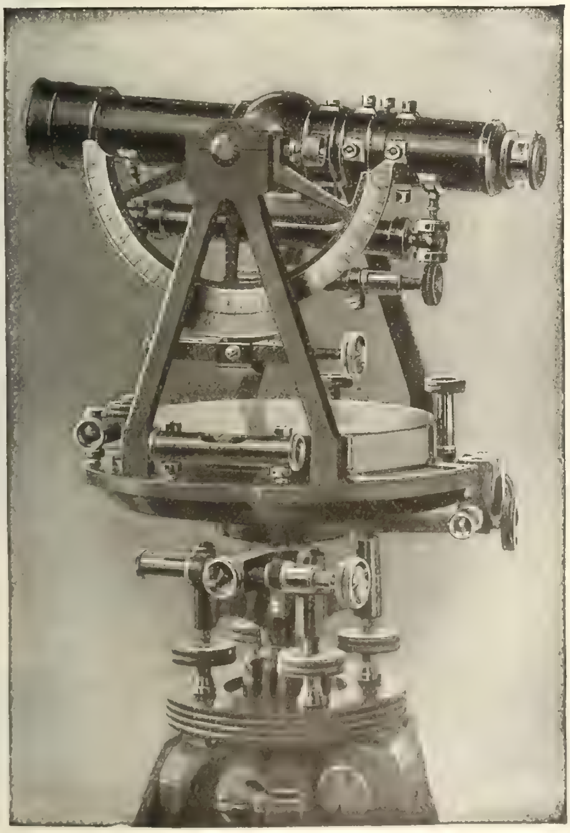

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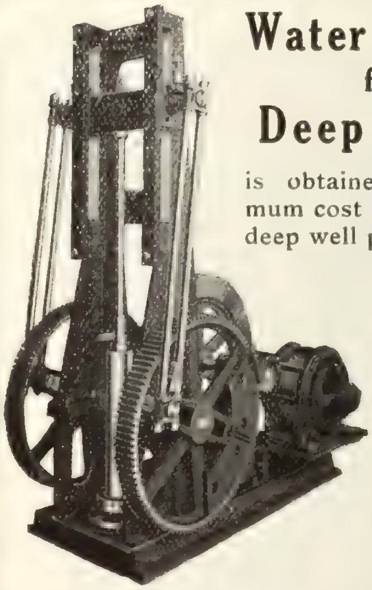

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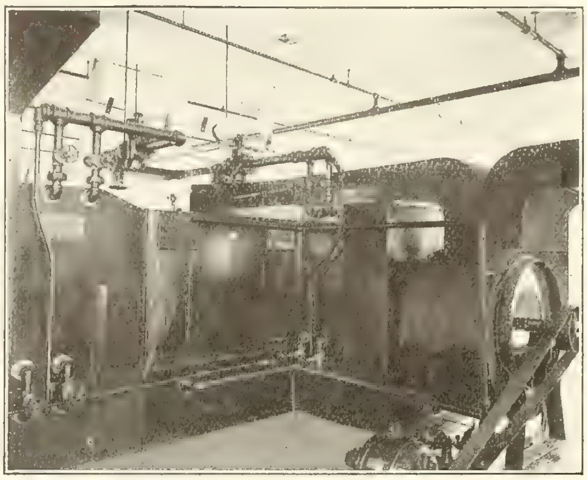

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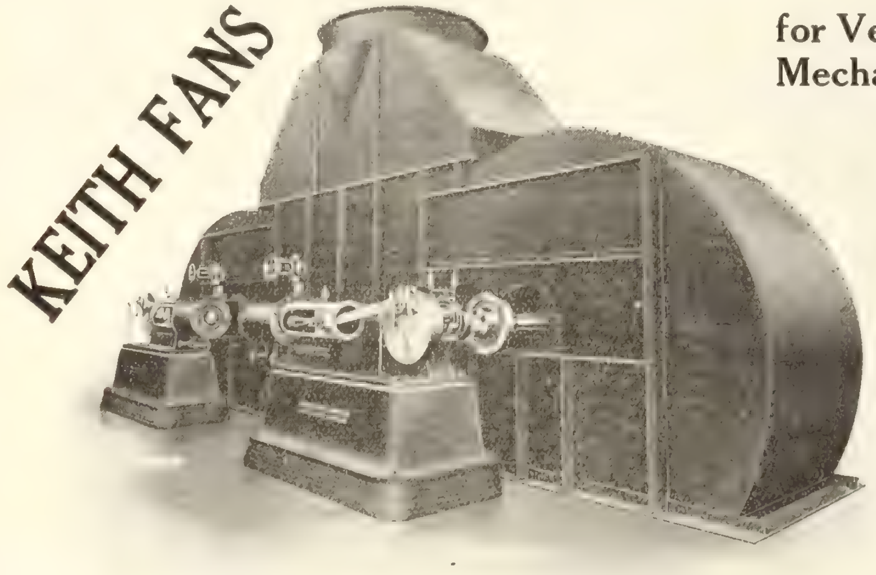

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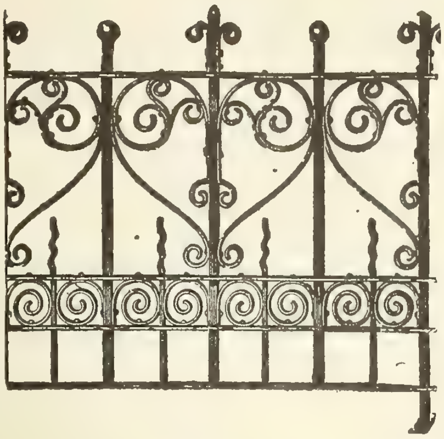

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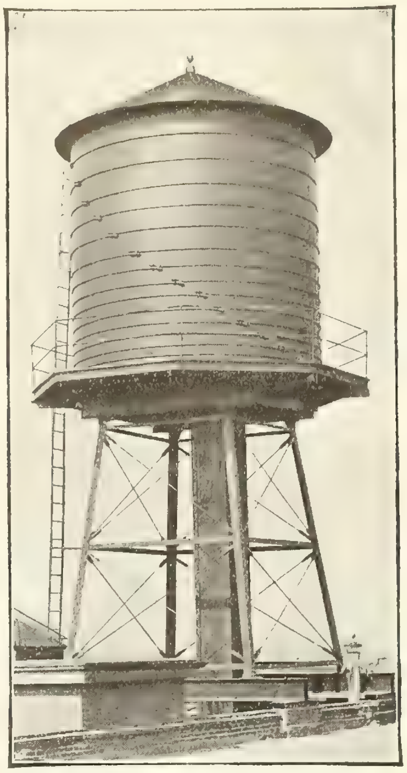

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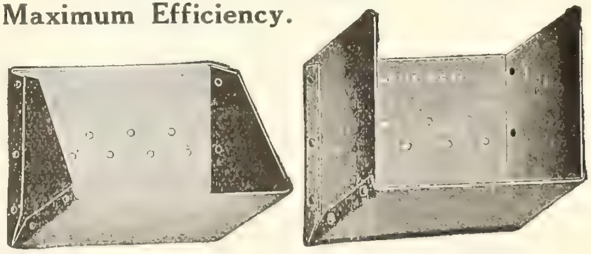

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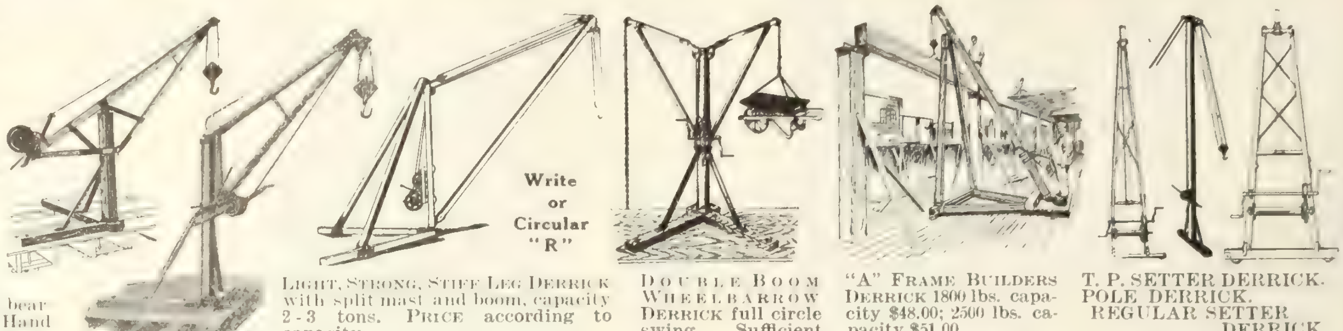

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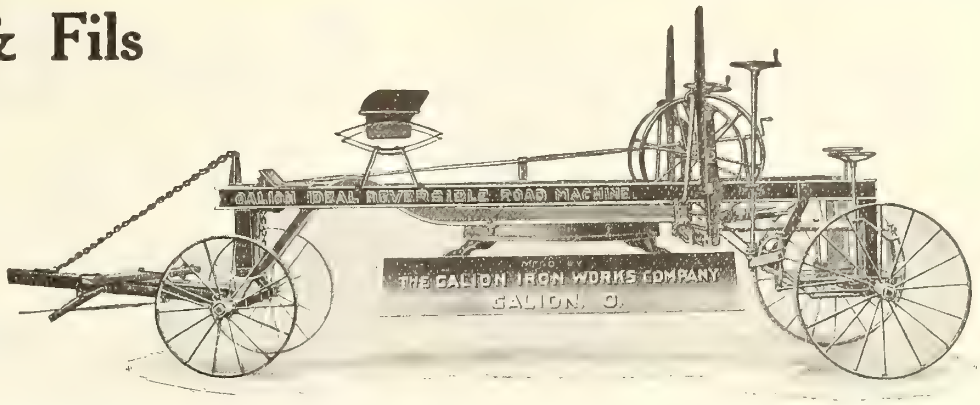
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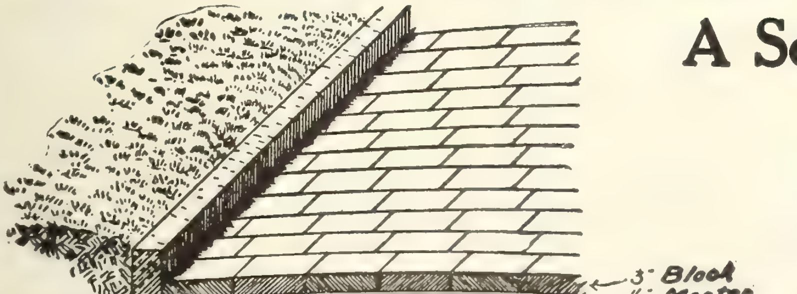

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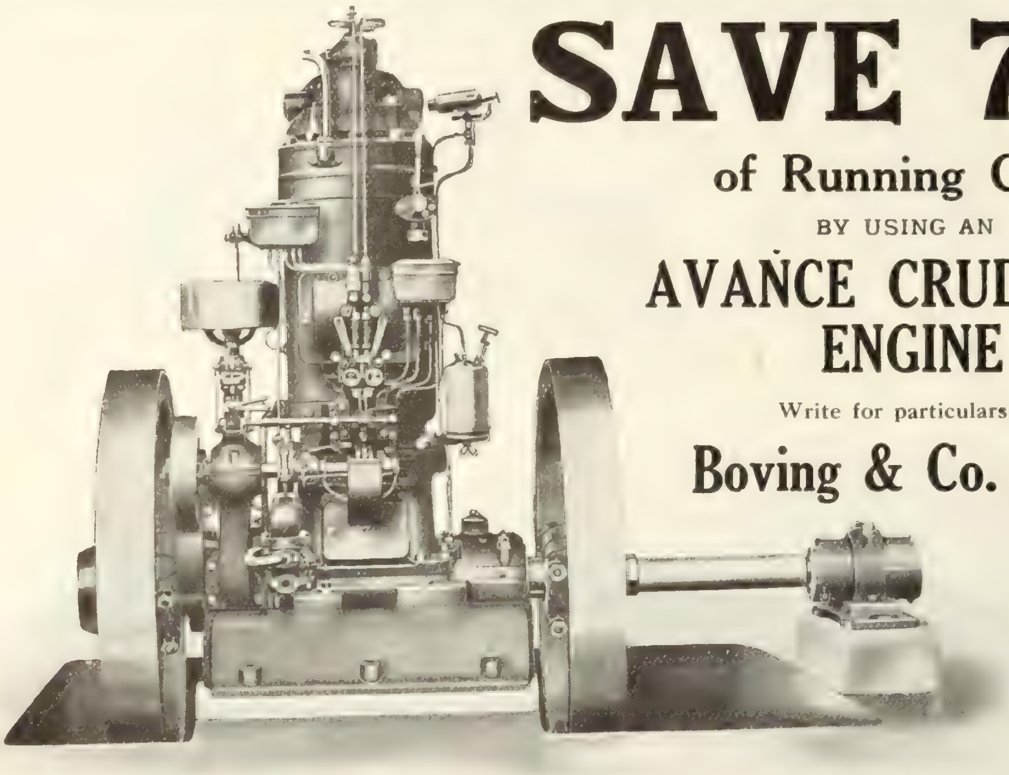

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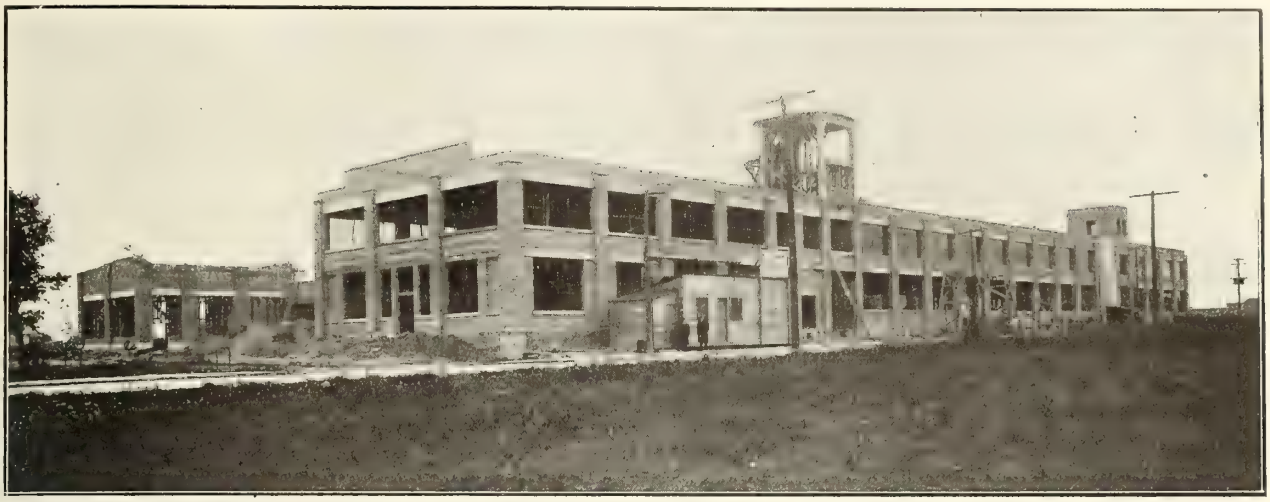

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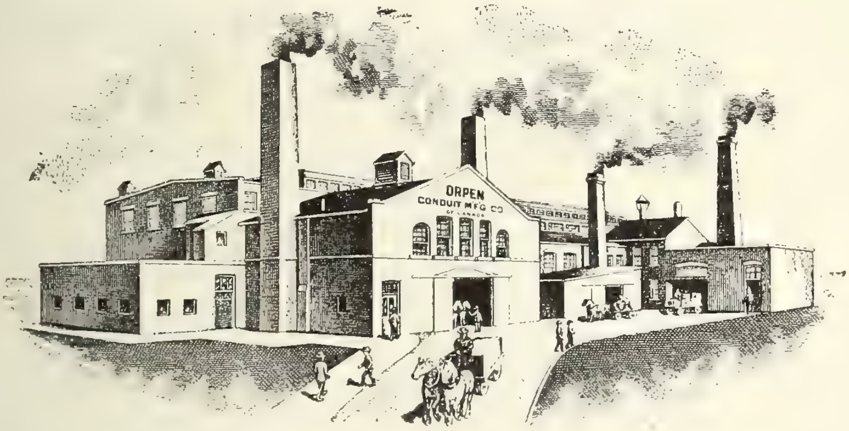
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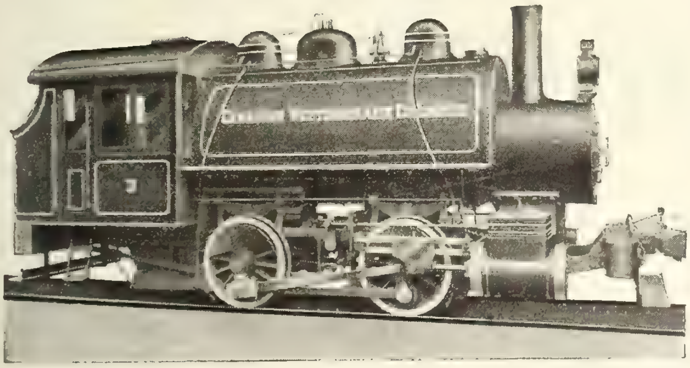

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for all kinds of concrete work

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Let us quote you prices.

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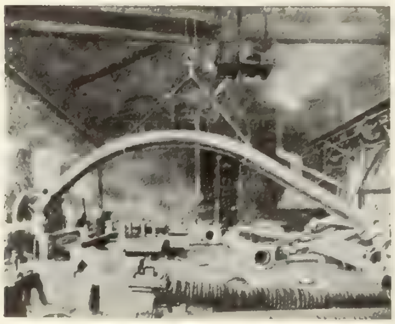

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economize space,
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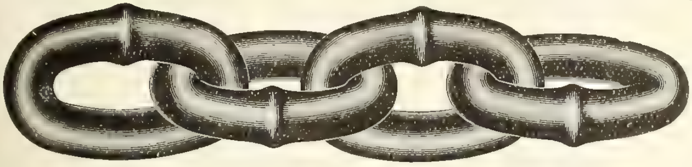

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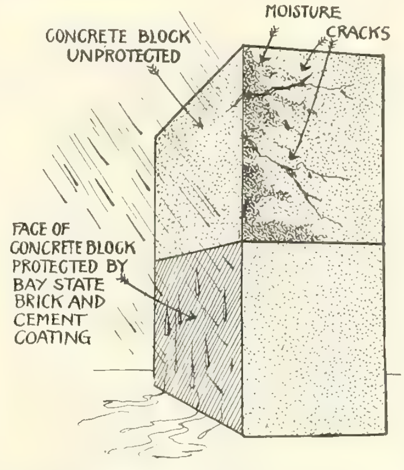
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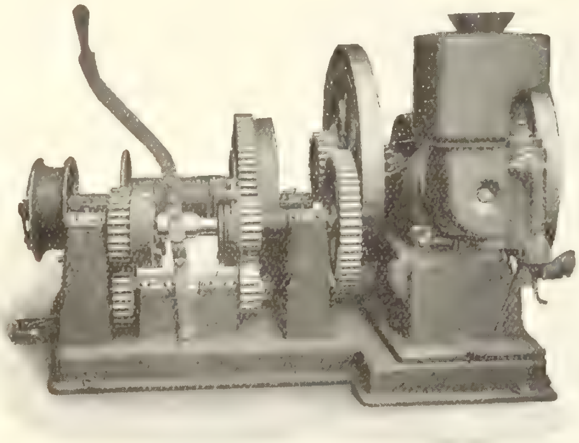

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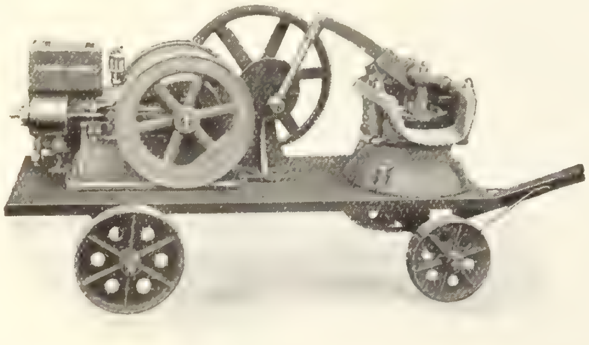

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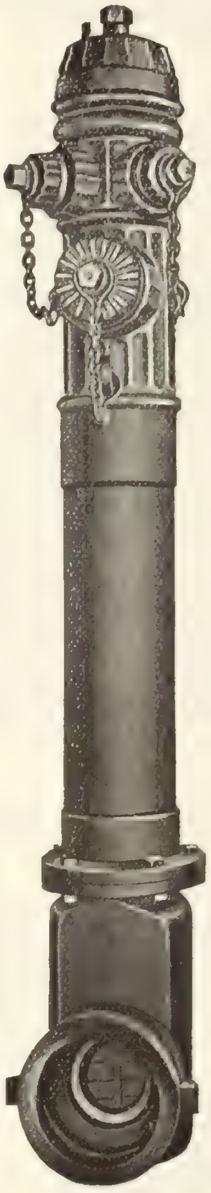

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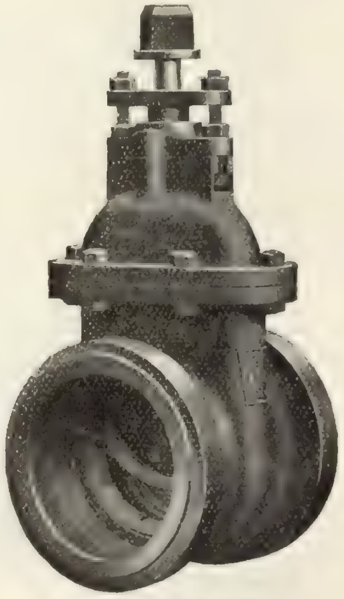

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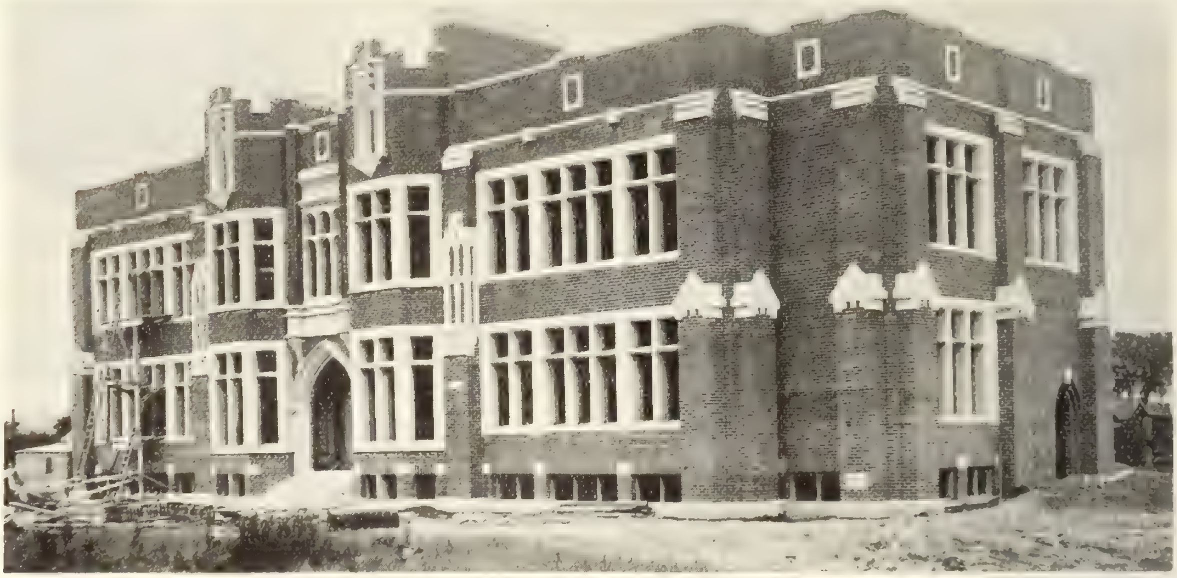

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ESTABLISHED 1886

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An Astonishing Failure and a Timely Lesson

THE astonishing failure of the Canada Iron Corporation, as revealed by a statement recently submitted to the bondholders by the Western Canada Trust, is an impressive plea for placing our concerns on a solid financial basis and adopting a sane policy of development within the limitation of our resources. When the first news came of the Canada Iron Corporation's difficulties it was inferred that the two hundred and fifty thousand dollars which the directors sought to borrow, in priority to the existing debenture charges, represented the total amount required to restore the company's fortunes. It is astounding to learn that in order to avoid disposing of the business at a break-up price it has been found necessary to close down the blast furnaces and the mines, and to confine business to the foundries.

The insolvency of the Corporation is attributable, we are told, to losses incurred in working the mines and blast furnaces, and to the heavy capital charges incurred on account of these branches of the business. In short, one of the leading institutions of the Canadian industrial world has failed owing to bad management, poor financing and inability to provide for the expansion which must be reckoned with in a country of rapid progress like Canada.

Occurrences such as these militate against the best interests of Canadian trade. It is not so much the failure of an individual concern that matters, as the reflection upon really sound industry in quarters where it is most desirable that we should hold an unblemished reputation for a conservative and sane, if enterprising, policy in regard to things financial.

As a country we have embarked upon great undertakings in the construction and operation of which we shall be dependent upon London and other great markets for millions and millions of dollars. Mistakes, financial and otherwise, have to be paid for. The frenzied finance of the Canada Iron Corporation constitutes a particularly flagrant example of what to avoid.

It is significant to find that this failure has been the subject of somewhat extended criticism on the part of the London Financial Times, thus developing the wider aspect of the situation to which we have referred above. In urging the need for greater liquid resources, the Times deplores the number and seriousness of recent failures of companies operating in the Dominion. It concludes:

"If Canada wishes to retain the confidence of British investors it will be necessary for the leaders of industry in that country to adopt a far more conservative financial policy than has hitherto been customary and to refrain from attempting to carry on a volume of business which no English concern would dream of doing without much greater liquid resources than appear to be deemed necessary on the other side of the Atlantic. We are quite prepared to believe that the iron and steel industry in the Dominion will develop very rapidly during the next few years, and the capital employed therein will earn a good return. All this, however, is of small consolation to those who, having subscribed the necessary funds for the equipment of such undertakings, find their securities severely depreciated and a receiver in charge of their business at the first sign of adverse money conditions. Canadians are fond of telling us that they are no longer children to be held in leading strings, but that, on the contrary, they are a great nation. If they really desire to be regarded in this light they must act a great deal more circumspectly in commercial matters, and not allow their desire to do business to outrun their financial discretion."

Another Phase of the Finance Question

PASSING from the problems of finance which engage the attention of industrial concerns we are reminded of an entirely different aspect of finance in regard to municipalities. Quite recently there have been brought to light a number of cases where cities and towns have been obliged to postpone—and in some cases cancel—for lack of funds, the construction of various works that are absolutely imperative from the public health standpoint. Several towns in the province of Ontario have lately received orders from the Provincial Board of Health either to make radical changes in the sewerage systems that they have in operation or else to install entirely new systems. It is only to be expected that such changes are necessary when one considers the abnormal increase in population of late years. In many cases municipalities have entirely outgrown themselves in a decade and the sanitary provisions of a few years back have become hopelessly inadequate to taking care of the new population. Unfortunately, many of the towns which have received orders from the Provincial Board of Health, while fully realizing the seriousness of the situation and appreciating the necessity for the extension, have been unable to comply with the orders owing to the problem of securing money at a time when it is difficult to borrow it advantageously.

It would seem that in cases where, in the interests of the community, it is desirable to improve sanitary conditions, some assistance should be given by the Provincial Government, so that the orders of the

Board of Health can be enforced. It is a strange anomaly that what is deemed essential by the Provincial Board of Health—what, in fact, is decreed by the authorities, is impossible of fulfilment because of the money involved.

Such a state of affairs would not be tolerated for one moment in England. There, the responsibilities in connection with improvements of this kind are assumed by a Municipal Government Board to whom any town or city experiencing trouble due to the inadequacy of its sewerage or water systems, can apply for assistance. This Board sends one of its engineers to make an exhaustive report on what is required and if the report is favorable the necessary funds are provided at a reasonable rate of interest and the work is put in hand immediately.

When one compares the shortcomings of our own practice with the satisfaction that is derived from the procedure of the older countries, one cannot help thinking that although we are progressing rapidly we have yet many useful and important lessons to learn.

Channel Tunnel Project Materializing

ACCORDING to information given in an article published on another page, the romantic elements of the Channel Tunnel project are being sifted out, leaving a residue of solid material for engineers to reckon with. The C. N. R. tunnel through Mount Royal is one of the most spectacular pieces of engineering that we have had in a long day, but the tunnel under the English Channel would eclipse everything and provide the technical journals with descriptive matter for a decade.

From what we hear, Chief Engineer Brown, who is engaged on the Mount Royal tunnel, is greatly interested in the Anglo-French project. According to a statement credited to him, Mr. Brown has been considering the military aspects of the matter, pointing out that England's defences would not be endangered because in time of war the tunnel could be flooded at either end if need be.

Certain it is that as time goes on the engineering profession is coming to regard the tunnel project more seriously. There was a time when the authorities in the Old Country became hysterical over the annual discussion of the question. This is one of the things that have given place to "something new, to something strange." At any rate the project is growing in favor and its prospects are brightening from the engineering point of view.

A Profitable Educational Arrangement

THE educational authorities of the county of Cheshire, England, will have the support of the engineering profession in taking the initiative in the matter of instituting scholarships between colonial universities and those of the United Kingdom. We understand that the authorities of McGill University have come to an arrangement whereby the Cheshire County scholarships may be held for the whole or a portion of the term of three years at McGill. From what we can gather, the educational authorities in the old country seem to have rather exaggerated views as to the number and importance of engineering vacancies in the colonies, but Canada has such excellent prospects along the lines of general constructional activity that encouragement should be given to such a movement.

The Woman Architect

WE congratulate those who are advocating the claims of woman, says our London contemporary, The Builder. In connection with the exhibition to be held next year in the City of Cologne, it was decided—at the eleventh hour—that the building to be devoted to women's work in decorative art as applied to the house, statuary, painting, drawing, fashion designing, toys, etc., would be most fittingly housed in a building designed and carried out by women. So a competition was announced limited to women, with the result that a German was placed first, an Austrian second, and another German third. A dozen women in all competed, and the first design is described as being well proportioned and dignified, and is said to need little alteration. The judges paid a tribute to the powers of all the competitors to realize the details necessary to the housing and display of exhibition goods, and to the capacity shown for applying artistic ideas to the building and its internal decoration and arrangement. We think that the pioneers of the women's movement in architecture are in some ways fortunate when we hear of a competition in which three premiums are offered and only twelve competitors enter, and contrast it with some of our ordinary competitions. Would the conditions of such a competition permit a married man to help his wife in an inferior capacity—say, to work out her rough sketches? We ask this question in the interest of our readers. We shall hope to chronicle many other successes of the fair sex until a ladies' building journal exploits the new and—shall we add?—virgin field.

Something About Advertising

THE failure of a trial advertisement has set more business men against advertising than any other factor in publicity. This is a pity when the indefiniteness of a trial advertisement is considered. A trial advertisement represents low water mark—absolute bottom.—It is not decisive. It has no more value as evidence than a first meeting with an individual who afterwards becomes your friend. Of all the advertisements in a long campaign, the first ad is the worst, though it is written by an adept. If it is written by a novice in advertising that novice will never write a weaker one. It is like the first discord struck out of the piano by a beginner. If a student becomes disgusted with such an initial effort he will never get farther, and if a merchant abandons his advertising intentions because the first advertisement was unremunerative, he will never get farther. The first attempt of anything is valuable only as an educator. Advertising is like seed sown, it's got to have time to grow before you can reap the harvest.

If a paper, after careful examination, impresses you at all favorably, it's worth giving a fair trial. In no case should a trial ad be inserted for less than six months. If the paper is going to be a paying investment for you, it will begin to show results by that time.

There is a big difference in feeding a cow just enough to keep her alive, and feeding her enough to create a profit.

The same is true about advertising. Nine times out of ten a small advertisement inserted one or two times is simply a waste of money, while the same advertisement inserted for six or more months would have become a paying investment.

Rialroad Work in Canada not So Bad in Comparison

IN an article dealing with the construction of the Cape to Cairo Railway, a writer in Colonial Life says:—"The work has been stupendous and the difficulties immense. There has been the unfriendly attitude of the natives to contend with and overcome; encounters with lions, elephants, and other wild beasts in the northwestern parts of Rhodesia; and then, as the Congo was approached, the ravages of the white ant and other termites had to be reckoned with. On one occasion a construction train was puffing along with a heavy load of material near Gwelo, when a full-grown lion was sighted stretched right across the line and basking peacefully in he sun. In reply to the whistle of the engine the brute looked up lazily, but did not attempt to move. The efforts of the driver and stoker to drive him off the line by pelting him with billets of wood were equally futile. The train was on the point of coming to a standstill when the lion took a sudden spring at the engine. Again and again the beast sprang, falling clear of the engine every time. The driver then realized that the best thing to do was to go full steam ahead and trust to the weight of the trucks behind him to keep the train on its line and clear the lion from its path. This was done, with the result that the lion—a magnificent specimen—was cut to pieces by the engine wheels. Quite a number of natives have lost their lives by being carried off by lions while asleep in their camps. Elephants have given trouble by tearing up the roadbed and pulling down the telegraph wires and upsetting the posts."

Concreting in Cold Weather — A Timely Enjoinder

IT is none too soon to start preaching against the dangers of careless work in winter concreting. Despite the emphasis placed on the subject there has been a harvest of disasters each winter, serious always in the financial loss, and sometimes in life. Without doubt the dangers are now appreciated by a greater number of contractors and inspectors than ever before, but the increase in the number of users of cement seems to have exceeded the spread of sound knowledge of its use. The recruits and the older users who, fortunately, may have escaped disasters through luck rather than intelligent care form a large enough body to appall even the most enthusiastic campaigner.

Fortunately, there is promise of help in many quarters. The Universal Portland Cement Company has recently issued a third edition of its pamphlet, "Concreting in Cold Weather," most valuable for contractors, foremen and inspectors. Other cement companies also are preparing literature, and at least one company will use its advertising space in technical and contracting papers to preach sound doctrine on cold weather concreting. There cannot be too much co-operation. The cement companies owe it to their industry to make each salesman a missionary to warn against the dangers and teach the precautions necessary. Special efforts, more strenuous even than those of recent years, should be made to enlist the help of the jobber.

Engineers and architects have a responsibility no less serious than that of the cement companies. In fact, this journal has repeatedly taken the stand that, as technical directors of the work, they should be held criminally liable for accidents resulting from inadequate precautions against freezing. Building departments, of course, share this responsibility and should exercise the closest supervision over concrete work within their jurisdictions.

The precautions necessary, moreover, are so simple that there is no excuse for not applying them. To discourage concreting altogether in cold weather is not only unnecessary but would result in tying up to no good purpose the capital invested in construction plant and in losses owing to postponement of the use of the structures. There are construction difficulties in other lines, but they are not allowed to interfere with the execution of the work. The heating of the material and the protection of the fresh concrete from freezing are sufficient measures to permit work to proceed in all but the very coldest weather. With intelligent supervision and close attention to the heating equipment there is no reason why even in zero weather pouring should not be continued.

The use of salt, however, is open to objection in reinforced structures, and while apparently not harmful in plain concrete should not be used where steel is embedded. It has limitations, moreover, as to influence, its effectiveness being practically nil at a point 10 deg. below freezing.

Persistent efforts, beginning at once, may help in lowering materially the disaster record made last winter. Cement manufacturers and their salesmen, cement jobbers, building department officials, engineers, architects and contractors experienced in cold-weather work can all bear a part in the educational campaign. The reward will come in greater confidence in concrete as a construction material and in the saving in life and property.—Engineering Record.

In a recent issue of Progress, an enterprising New Zealand contemporary, are published some observations on damp-proof walls in which it is stated that unless the composition of a wall is impervious to moisture, there is no advantage in a thick wall as against a thin one, for if the moisture will pass through one inch, it will pass through the remaining thickness. Therefore a thin wall with a coating of thin impervious plaster will exclude damp, where a thick wall with no coating will let it pass through. With a very thick wall, however, a moderate rain storm may not continue long enough to wet it quite through, but in the case of water tanks and similar objects, thick pervious walls are no better than thin ones, except in the matter of strength. Hollow walls are sometimes adopted for dwellings, the air spaces in the walls preventing the moisture from passing through to the inside. This is regarded as a cumbrous expedient, and after due consideration, reasonably thin and porous concrete walls with an impervious coating have been successfully adopted, making walls and partitions one standard thickness, and thus gaining space in the rooms, and time in erection, which means less cost and a better job altogether.

A tall brick stack has been erected for the J. Heinz Company, of Northside, Pittsburgh. The stack is 250 ft. high and tapers from a 23-ft. base to a 10-ft. top. Sixty-four concrete piles were driven 30 ft. for a foundation. Alternate courses of the brick are headers, and heavy steel bands have been inserted in the masonry at seven stages to provide for temperature changes. A similar stack, 60 ft. away, is soon to be built.

Colloids and Their Solution in Sewage and Water

By A. C. D. Blanchard, M. Can. Soc. C. E.

FOR the purpose of the present article it may be considered that a solid is dispersed in sewage or water in one of three different phases: first, in suspension; second, in solution; third, as colloids in colloidal solution.

No attempt will be made here to deal with either the first or second division above given, excepting to employ them for the purpose of comparison or contrast with the third and least understood.

Light is thrown on the theories concerning colloidal solutions by an interesting paper read recently before the Franklin Institute.* This paper, which treats the subject more or less from the point of view of the physicist, is both liberally quoted and referred to in this adaptation of the subject to the uses of the practical engineer.

For the sake of clearness it may be well to commence with a definition of colloids and their solutions, since few readers will have an exact conception of these phrases which have been used so frequently by technical writers without further explanations.

A colloidal solution is formed by the dispersion of a solid through a liquid, but the solid is not divided into separate molecules as in a true solution. The dispersion of the solid actually exists in fairly large collections or communities of the molecules composing the solid, the number in each group being variable. The solid elements thus dispersed are known as **colloids** and the solution formed is known as a **colloidal solution.**

Comparing solids in colloidal solution with either of the other two groups we find that solids in suspension will cause a turbidity which may be removed by settling, if left undisturbed, or by filtering through a filter paper. A true solution, on the other hand will not be effected by these treatments.

A colloidal solution occupies an intermediate position; Colloids will not settle out, even if left for long periods, unless some change occurs in the organic form of the colloid itself, or unless aided by a precipitant. But if passed several times through the same filter paper the solution will gradually become clearer. Examples of ordinary colloidal solutions may be found in the absorption by water of gelatin, glue, soap, and frequently, bacterial growths.

Inorganic substances, such as gold, sulphide of arsenic, etc., may be reduced to colloidal form in solution with water or other liquids, but these are not important in connection with the aim of the present discussion.

It is well to bear in mind, however, that colloids are always of amorphous nature, since crystalline substances dissolve into molecular or even finer particles, and never exist as groups of molecules in solution, which, as already explained, is the true nature of a colloid.

From the preceding remarks it may be inferred that colloids may partially be removed from either sewage or water by the subsidence of suspended matters which carry down with them a certain proportion in solution. The use of artificial precipitation by the addition of sulphate of alumina, ferric sulphate and lime, is also introduced as a preliminary treatment. Such an expedient however, obtains only partial results, as the liquid after treatment will still retain a proportion of its colloids in solution.

The question arises at once in connection with the phenomenon of the colloidal solution: why are colloids not actuated by the usual laws of nature, and either eventually float to the surface, or sink to the bottom of the receptacle containing the liquid. Assuming that the colloid is heavier than water, it is evident, that as the particles are reduced in size there is a rapid falling off in velocity of settlement. This is easily demonstrated, and formulae have been deduced showing the diminution in velocities of settlement as particles are reduced in size. There is nothing in these formulae, however, which would indicate that the subsidence would cease altogether unless the diameter of each particle were reduced to an infinitely small dimension. This fine division of particles is obviously not reached in colloidal solutions and hence we are forced to seek another explanation of the phenomenon. The answer lies in the theory of molecular motion or **heat.** "The particles (of the colloid) are battered on all sides by a hailstorm of molecular impacts. If the particle is large the blows of the molecules of the solvent in different directions neutralize each other. But when the particle is not very much larger than the molecules themselves, a molecule striking, say, on the left, will give the particle a very perceptible push toward the right and the cause which prevents the particles in a colloidal solution from settling is in no way different from the cause which prevents the earth's atmosphere from subsiding to a snowy layer a few feet deep on the surface of the planet."†

Having thus reached an explanation of the phenomenon of the colloidal solution as it occurs in connection with the problems of water supply and sewerage, it may be well to review briefly the methods which have been employed to remove colloids in the process of purification.

In the disposal of sewage this has been attempted in many ways and with varying degrees of efficiency.

First, by Subsidence.—This removes only an extremely small proportion of colloids due entirely to the settling of suspended particles with colloids attached.

Second, by Chemical Precipitation.—A considerable proportion of the colloidal component is removed by this method, but the expense involved is hardly commensurate with the success in comparison with other schemes.

Third, by the Use of so-called Colloiders suspended in a Preliminary Treatment Tank.—The object sought is to attract the passing colloids to thin battens or slabs of wood or concrete hung vertically in the tank. Colloids have a tendency to collect and adhere to these obstacles and eventually the mass collected on a colloider attains such proportions that its weight causes it to detach itself and it sinks to the bottom, where it becomes part of the accumulation of sludge. This method, however, has been shown to be but partially efficacious, and the operation of such a tank is rendered difficult by the many parts of which it is composed.

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* "Colloids and Crystals, the Two Worlds of Matter," by Robert H. Bradbury, Philadelphia, Member of the Institute.

† Mr. Bradbury.

Fourth, by Oxidation or Biological Action.—This is accomplished either by admitting the liquid to contact beds or by spraying, or otherwise distributing the liquid upon filters. The latter method, usually applied in conjunction with preliminary subsidence, would appear to be the most economical for usual cases, and has rapidly gained in popularity during recent years.

In the purification of public water supplies the methods adopted for the removal of colloids depend largely upon the general quality of the water to be treated, since colloids do not occupy so prominent a place in the ordinary water supply as other elements of impurity, e.g., colloids in sewage. For this reason the type of filtration works adopted depends upon other constituents of water. The method usually employed having in view the removal of colloids along with other impurities are either, (a) slow sand filtration; (b) rapid sand (mechanical) filtration, either with or without treatment by a precipitant; (c) other miscellaneous types involving principles of either or both of the above.

Such colloids as are not deposited by precipitation are passed on to the surface of the filters and there retained, and either become oxidized or broken up by biological action, or are disposed of in the washing of the filter medium.

Obviously the efficient disposal of colloids, particularly in sewage, is one of the great problems which confront the sanitary engineer. It should be his first aim therefore to improve, as much as possible, the mechanical efficiency of the conduits which bring the sewage to the treatment works in a way that the comminution of solids colloidal form may be checked as far as possible, by conducting the sewage by the most direct route; by eliminating manhole drops and violent curves; by avoiding irrational velocities and poorly selected pumping equipment often met with even in large and important systems.

Springfield Sewage Disposal Plant and Its Departure from Common Practice

By Alexander Potter, Consulting Engineer, New York

THE city of Springfield, Mo., is located two hundred and forty miles southwest of St. Louis, among the foothills of the Ozark mountains, 1,400 feet above sea level. During the last decade the growth of the city has been very rapid. The population in 1900 was 23,000 and in 1910 it was 34,000. The present estimate is placed at 46,000. The area of the city is fourteen square miles.

The last two administrations have been progressive and public-spirited to a marked degree. Large sums have been spent on much-needed public improvements; so that where a decade or so ago Springfield was only a sleepy, over-grown town, it is now a hustling and up-to-date city.

The built-up part of the town is sewered and recently sewer extensions have been built into the fast growing outlying districts of the city. Up to the present time over 105 miles of public sewers have been completed.

A ridge running east and west divides the city into two distinct drainage areas, known as the northern and the southern areas. The northern area, which is the smaller of the two, takes in about two square miles and is drained by a number of small streams which discharge into the Sac river. The southern area takes in all of the thickly populated districts, including the new addition south of the city.

Necessity of Sewage Disposal

During the greater portion of the year the natural flow of all of the streams is so small that they are unable to assimilate the large quantities of sewage that are constantly discharged into them. In the spring of 1911 the nuisance from raw sewage discharged into these streams became so serious that the city authorities realized that unless immediate steps were taken to abate this nuisance the city would make itself liable for damages.

Before calling in an engineer to design the much-needed improvements to the sewerage system, the city appropriated $100,000 to construct sewage treatment plants at two sewer outlets. After appropriating this money the city proceeded to call for bids upon contractors' plans and specifications. This plan was abandoned, however, before the contract was let, and the city retained the writer to design and supervise the necessary sewage disposal plants.

Outline of Improvements

The ridge extending east and west through the city made it necessary to construct two sewage disposal plants. The most logical location for the sewage disposal plants for the northern district was near Doling Park, directly north of the city limits at the mouth of the existing sewer. In the southern district the ordinance called for the construction of a sewage disposal plant at the mouth of the main outlet sewer, To construct a sewage disposal plant at this point was not recommended. The site is low, subject to inundation, and pumping would have been necessary.

On account of the small quantity of water flowing in Wilson and Jordan creeks during the greater portion of the year, the treatment of the sewage in settling tanks alone would not give a sufficiently pure effluent to abate the nuisance. Some additional treatment, such as contact beds or intermittent filters, was therefore absolutely necessary. To obtain a head at the southern outlet sufficient to operate a filter would back up the sewage in the main outfall sewer for a distance of at least 3,500 feet. This sewer, which is an egg shaped brick sewer, 28 inches by 42 inches, was not strong enough to withstand any internal hydrostatic pressure without rebuilding. Above its mouth the outlet sewer for a distance of 3,200 feet has a fall of only 4.6 feet; at this point there is a two-foot drop and the grade increases to 4.1 feet per thousand. It was recommended that the treatment plant be built at the point where this change in grade occurs. To obtain at this point the necessary head to operate the plant only 2,000 feet of sewer would be surcharged.

For a distance of 1,436 feet, that portion of the length where the hydraulic gradient falls above the natural surface of the ground, the existing egg-shaped brick sewer was replaced with 36-inch reinforced concrete pipe of the Meriwether type, designed to resist this pressure. This reinforced concrete pipe has been found very satisfactory under the head to which it was subjected, viz.: from 3 feet to 10 feet, and the line appears to be practically watertight. The existing sewer below the sewage disposal plant was not rebuilt and is used to convey the effluent from the plant to the outlet.

Type of Plant Recommended

On account of the limited area available it was deemed advisable to use intermittent filters instead of contact beds. The ordinary type of sprinkling filter could not be used, as such a filter requires a head of at least five feet to operate the nozzles. Such a head could be obtained only by pumping. Mechanical distribution was therefore recommended. The distributor selected is operated with a head of only 12 inches.

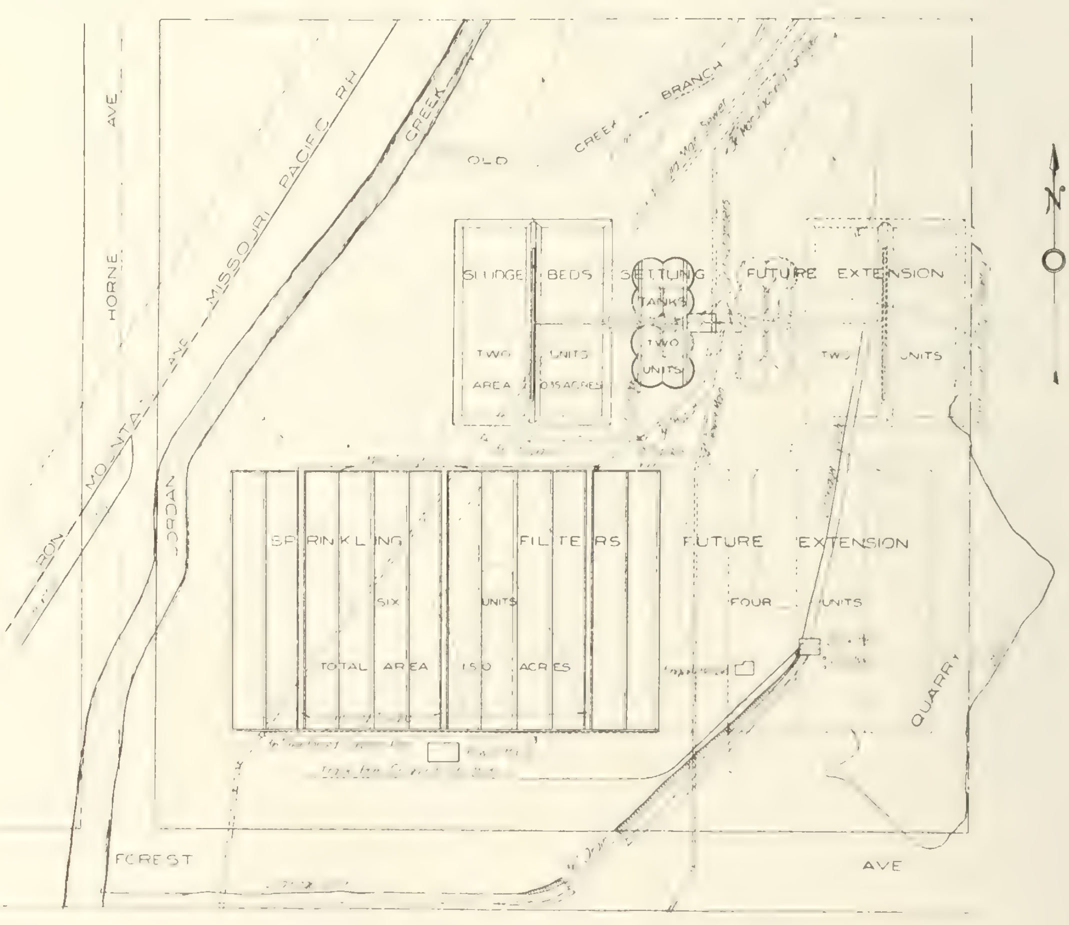
Plate 1 shows the general arrangement of the plant as built. It consists of a grit chamber built in duplicate, two settling tanks of the two storey type, a sprinkling filter divided into six units, each 53 feet 9 inches wide and 200 feet long, a sludge bed 0.35 acre in extent, and a final settling basin of 150,000 gallons capacity, located at the outlet, 3,600 feet from the remainder of the sewage disposal plant.

Grit Chamber

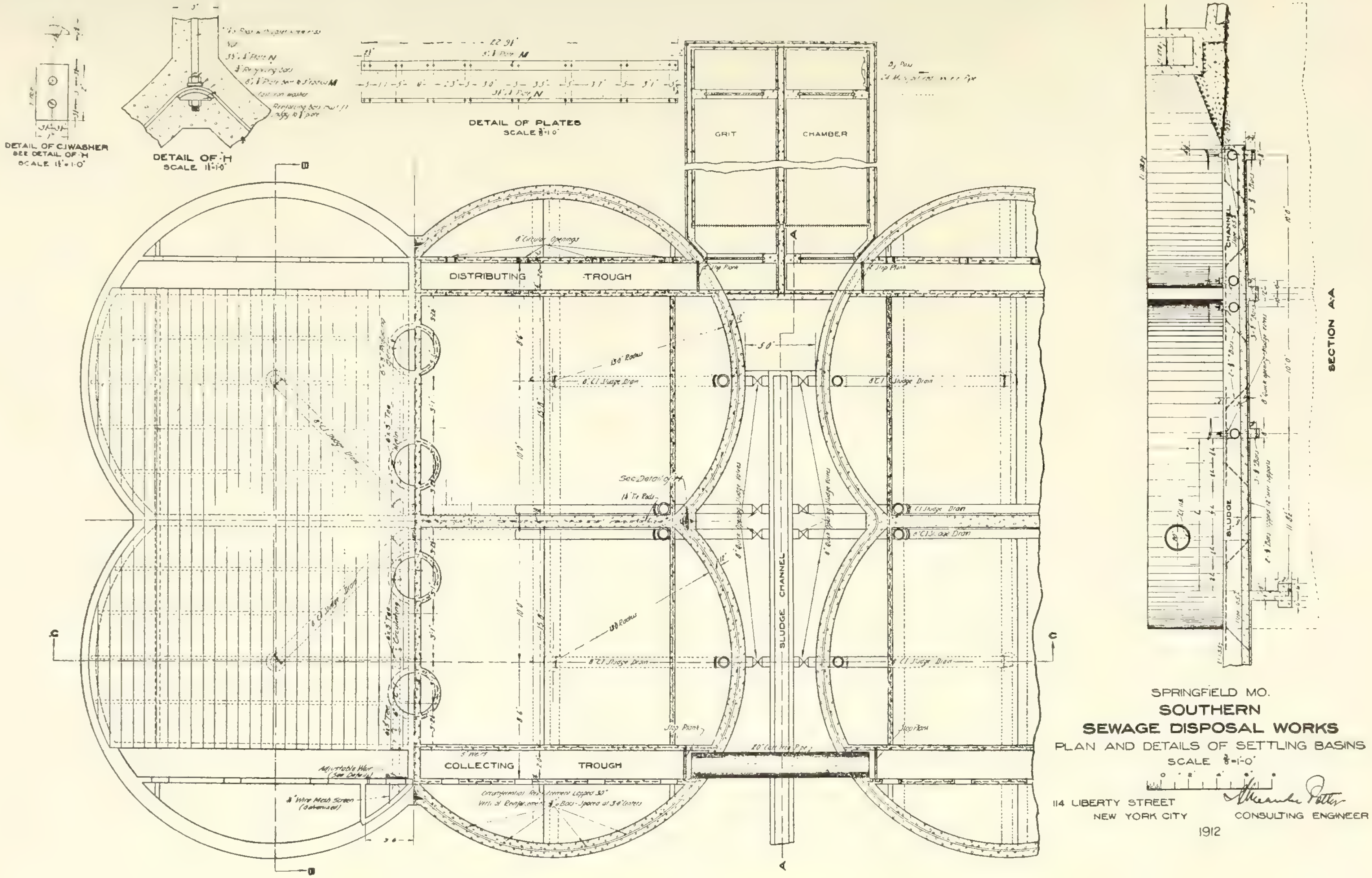
The grit chamber is constructed in duplicate. The flow in the grit chamber is retarded sufficiently so as to retain only the suspended mineral solids which would interfere with the operation of the settling tanks. Provision is made so that during times of flood the back pressure on the outfall sewer can be readily and quickly relieved, thus scouring out whatever deposits may have formed in the 36-inch reinforced concrete pipe.

Settling Tanks

Type Selected. Concrete, either plain or reinforced, is practically the only structural material available for constructing sewage settling tanks of the dimensions required for a large municipality. So far as the writer knows, the circular tank has been used in this country only in constructing the smaller units; for the larger sizes it has been customary to use rectangular construction. The rectangular form under all conditions, and especially when a large portion of the tank is above the surface of the ground, is a more expensive form to build. The Springfield sewage tanks are neither square nor truly circular. Each unit is four-leaf-clover shaped, consisting as it does of four semi-cylindrical segments 26 feet in diameter. This type of construction is peculiarly well fitted not only to resist the water pressure from within, but also the earth pressure from without when the tank is below the ground and empty. The construction features of the tank are clearly shown in Plates 2 and 3. The shell of the semi-circular segments is 12 inches thick, reinforced vertically with ¾-inch bars spaced 3 feet centers and circumferentially with ¾-inch square bars spaced so that the unit stress does not exceed 14,000 lbs. per square inch. The unbalanced tension at the



1.—Location Plan of Southern Sewage Disposal Plant.



2.—Plan and Details of Settling Basins.

point where the semi-circular segments intersect is taken up by 1¼-inch circular rods embedded in concrete struts—see Detail H of Plate 2.

The steel reinforcement in these ties is designed to resist the tensile forces at the same unit stress as the circumferential reinforcement in the shell. If this is not done, and different stresses are used for the tie rods than are used for the shell, the shell, instead of being subjected to simple tension, will be subjected to bending. The tie rods are fastened to a steel plate 8 inches wide, ⅞-inch thick, bent to a 5-inch radius. By means of double nuts the reinforcement is kept in accurate alignment which insures equal distribution of the tension among the larger number of the tie rods.

Precaution Necessary to Prevent Secondary Stress. The cylindrical segment must be free to expand in all directions. If the expansion is is any way prevented by interior construction, such as the troughs, false bottoms, beams, etc., the shell, instead of being under tension only as contemplated by the designer, will be subjected to heavy bending, often sufficient to cause the fracture of the structure. To permit of the free expansion of the shell when under internal pressure, all interior construction, except at the intersection of the ties and struts with the shell, is separated from the shell by expansion joints.

Operation of Tank. After passing through the grit chamber, the sewage enters the distributing trough, which is 2 feet wide, and holds, under normal conditions, about 2 feet of liquid. (See Plate 3.) Eight 8-inch circular openings, placed in the sides of the trough near the bottom and on the side next the outer wall, admit the sewage to the settling compartment. At the end of the trough is an additional opening, placed so as to be but half submerged, so that whatever scum may tend to collect in the distributing troughs is carried over into the settling compartments. Each settling compartment has a capacity of 111,000 gallons, which gives an average period of retention of 1.4 hours when the plant is operated at 4,000,000 gallons, its capacity. The flow in the settling compartment is parallel to the direction of the slot. To prevent eddies and other disturbances from being set up in the settling compartment which might interfere with the settling efficiency, the liquid is admitted to the settling compartment in a direction opposite to that which it must take in passing through the compartment. The clarified sewage leaves the settling compartment over eight 15-inch weirs discharging into the collecting trough.

Concrete Struts not objectionable. The presence of the concrete struts in the settling compartment does not in any way interfere with the efficiency of the tank. Where necessary, they can be capped with wedge-shaped pieces of concrete having slopes of at least 45 degrees.

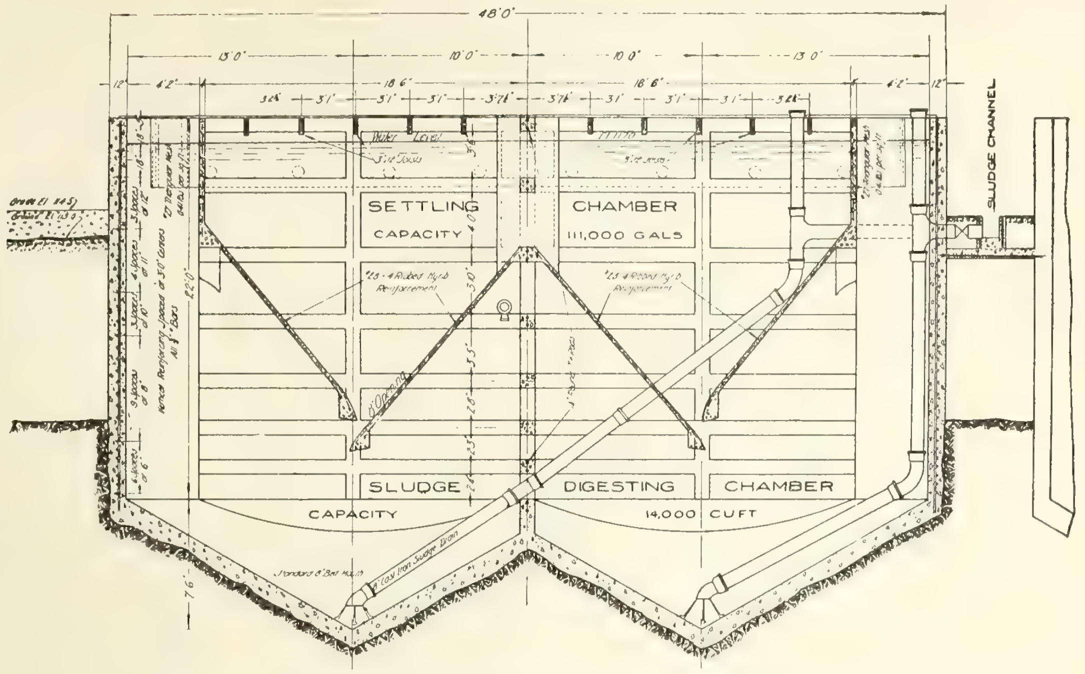
In that circular segmental area between the distributing trough and the shell of the tank, all of the floating matter is collected and forms a very heavy scum, requiring slight attention from the operator.

Vertical Circulation Used to Increase the Settling Efficiency of the Tanks. To increase the settling efficiency of tanks of the type described, the writer uses vertical circulation. The amount of sewage thus circulated is very small and does not exceed two per cent. of the total amount of the sewage treated. To accomplish the vertical circulation mentioned, a 6-in. cast iron main with four 4-inch circular openings is laid in the digesting chamber of each tank, about 6 feet above the slot. (See Plates 2 and 3). This circulating main terminates in a small chamber located in the segment between the collecting trough and the shell, which chamber has an adjustable weir to control the flow from the digesting chamber into the collecting trough. In the Springfield plant the liquid thus drawn off is mixed with the effluent from the settling compartment and the resultant mixture is treated on the sprinkling filters. In other plants that the writer has built, the liquid drawn off from the digesting chambers is returned to the distributing troughs. Circulation such as that used in Springfield is especially of value when the sewage to be treated reaches the plant in a more or less septic condition. The Springfield plant has not been in operation long enough to determine the exact value of the circulation system.

Sludge Digesting Chamber. The suspended organic and mineral matter which settles out of the sewage in the settling compartment, slides down the inclined plane through the 8-inch slots located in the bottom of the wedge-shaped settling compartments into the sludge digesting chamber. The sludge digesting chamber has a capacity of 105,000 gallons below the opening. The bottom of this compartment is formed by four cone-shaped depressions in which the decomposed sludge pipes extend down into these cone-shaped depressions, the sides of which slope at an angle of 30 degrees. The lower ends of these pipes terminate in bell-mouths supported on spiders. The sludge pipes are carried up inside of the tank to the top, giving ready access for cleaning. The sludge outlets, of which there are four for each unit, discharge under a 5-foot head into a reinforced concrete trough which conveys the sludge to the drying beds. The open channel used for conveying the sludge is preferable to the closed pipes generally used. In an open channel the sludge drawn off is at all times visible to the operator, and therefore the character of the sludge drawn off can be controlled far better than when a closed sludge conveyor is used. There is positively no odor during the operation of the sludge valves, either in the trough or upon the sludge beds.

Economy of Construction. The Springfield tanks have been found to be very economical in construction. Concrete and steel are used under ideal conditions to resist the pressures to which the tank is subjected. From the contractor's standpoint also the cost of constructing the tank is not excessive. To construct the conical bottoms of the digesting chamber a vertical pipe 2 inches in diameter was placed in the center of each cone and firmly braced. From this pipe was suspended a wooden triangle adjusted at such an elevation that the hypothenuse described the interior surface of the cone when rotated about the pipe. The concrete was mixed rather dry and placed in 4-inch layers and tamped as much as it would stand, the last layer being carefully brought to a true line by the swinging template. A ½-inch coating of 1 to 2 mortar was applied to the interior of the cones to give them a smooth surface.

To construct the outside shell of the settling tank the constructor used wooden forms made in 5-foot sections 2 feet high. A complete set of inside and outside forms was built extending entirely around one tank, and a complete ring 2 feet high was poured at one time. The following day the sectional forms were raised 2 feet and wired in place at the new point. No trouble was found in shifting the forms and holding the walls plumb and true to line. The false bottoms of the settling compartments were built of No. 28—4-rib hyrib plastered with mortar to a thickness of 2½



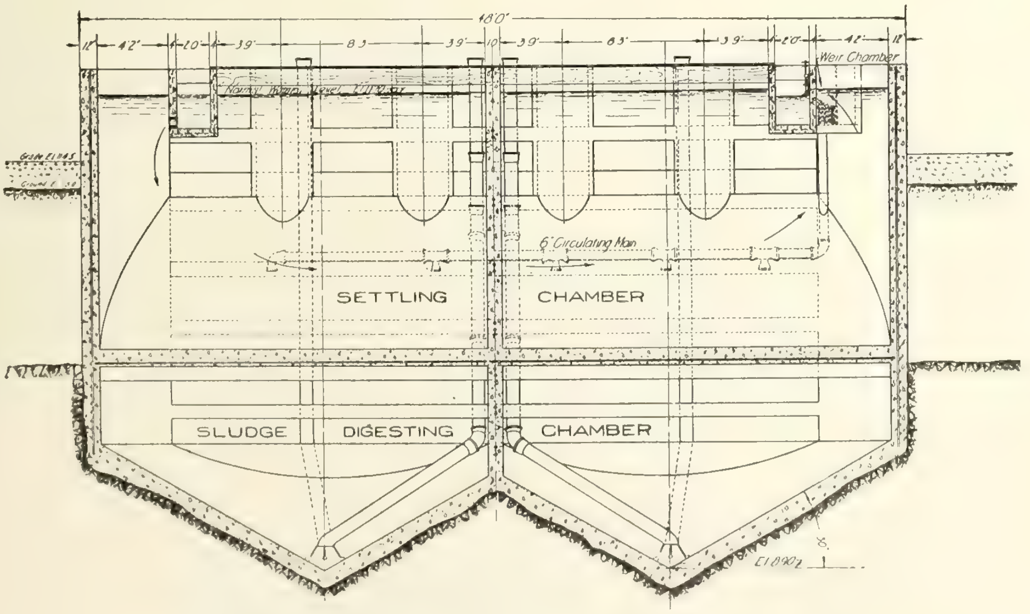
3A.—Detail Section of Main Settling Tank Section on CC.

inches. The circular ventilators also were built of hyrib and plastered with cement mortar, no other forms than templates being used.

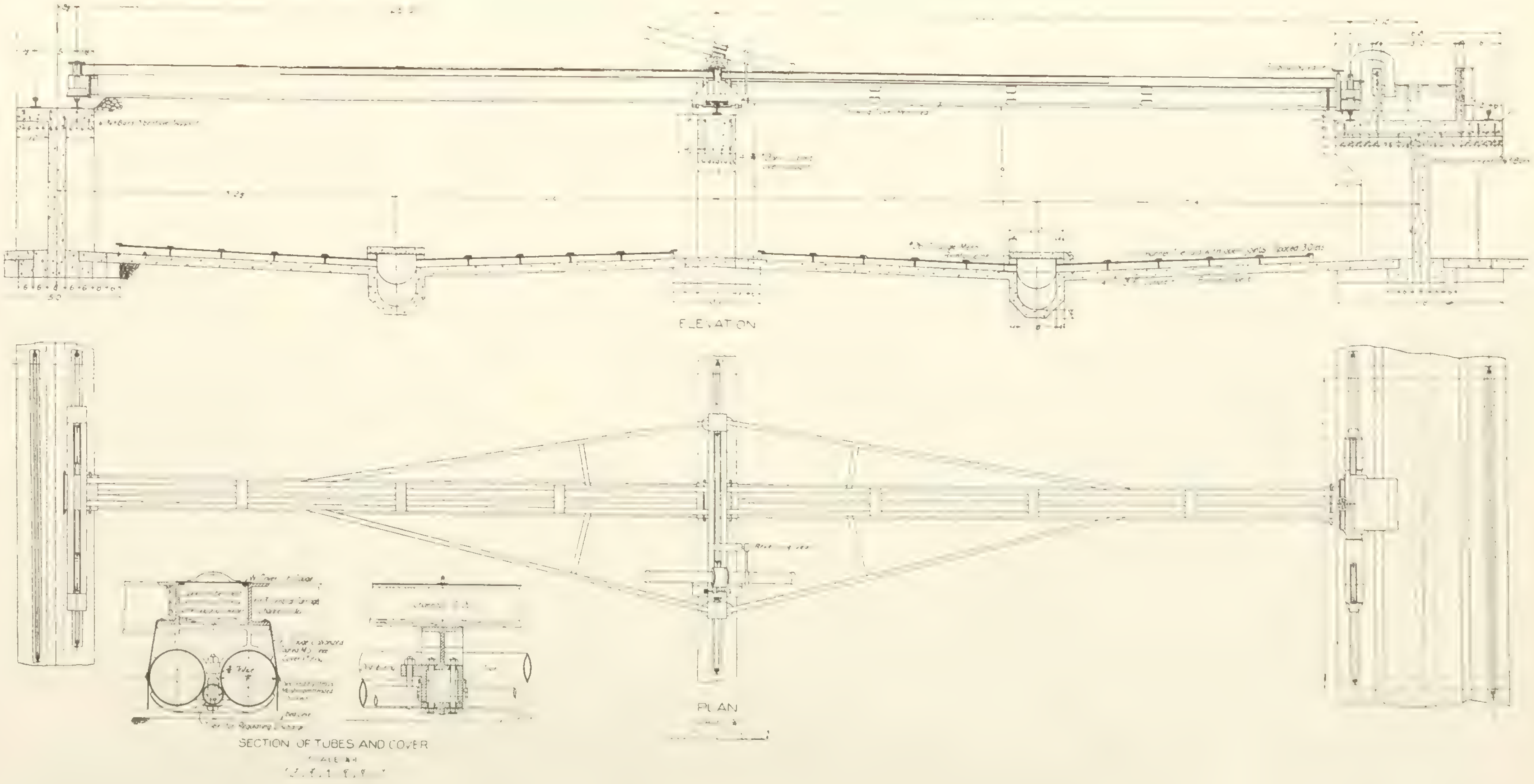
Intermittent Filters

To reduce the loss of head to a minimum power driven mechanical distributors are used to distribute the sewage on the filters. These distributors were manufactured by the Ham Baker Company of London, England. They are designed to distribute the sewage upon the beds with a loss of head, not to exceed 12 inches when the liquid is applied at the maximum rate of 720 gallons per square yard per day. Plate 4 shows the construction of one of these distributors. Each distributor is supported on three rails, spaced 25 feet on centers. The length of the travel is 200 feet.

The effluent from the settling tanks is conveyed by a 24-inch reinforced concrete pipe to a main distributing trough located at the north end of the filters. The lateral distributing troughs which supply the traveling distributors are fed by 3-foot weirs from the main distributor. The object of these weirs is to insure a uniform distribution of the liquid to the distributors. Plate 4 also shows the construction of the sprinkling filters. The depth of the filtering material ranges from 6 feet, 6 inches in the center to 6 feet at the sides. The



3B.—Detail Section of Main Settling Tank Section on BB.



4.—Section of Filter Unit Showing Travelling Distributor.

underdrains were not built as shown on the drawing. Instead of using 6-inch channel tile, the contractor was given permission to construct 6-inch semi-circular channels in the concrete floor and cover them with vitrified tile slabs. The main collectors are semi-circular in shape, 18 inches in diameter and of variable depth, the distance between them being about 25 feet. The rails on which the distributors travel are supported by concrete girders carried by piers spaced 12 feet, 5¼-inch centers. The area covered by each distributor is enclosed by an 8-inch concrete wall. The winter temperature of Springfield is sometimes so low that it may be questionable as to whether the traveling distributors can be successfully operated in extreme weather. Should the traveling distributors go out of commission or any of them break down, it is possible to utilize the filters or any unit thereof as a contact bed to be operated by hand, suitable gates being provided for this purpose.

Operation of Distributors. Extending down the center of the filters between two of the traveling distributors is a 3-foot rectangular conduit in which the normal depth of sewage is 16 inches. A cast iron siphon, 24 inches long and 8 inches in width, conveys the liquid from this trough to the distributor. This siphon is provided with a gunmetal air cock and brass air exhaust pump for starting the flow. The siphon discharges into the feed tubes, of which there are two. These feed tubes are made of wrought iron 3/16-inch thick and have an external diameter of 7⅜ inches. The feed tubes are supported at each end and at the center by a cast iron carriage braced together by rolled steel beams so as to form a rigid structure. In each feed tube just above the center are located ⅝ x 4-inch orifices, spaced about 15 inches lengthwise. The even distribution on to the beds is accomplished by a distributing tube 2½ inches in diameter, located between the feed tubes. This distributing tube is built in sections and can be raised or lowered as required to control the flow of sewage upon the beds. The feed tubes are protected with galvanized sheet iron covers provided with hinged access doors. The protection extends to within one inch of the surface of the bed in order to conserve the heat in the sewage as much as possible, especially during the cold weather. It also acts as a preventative of flies. A space is provided between the two channels supporting the feed tubes, which during the cold weather is to be filled with moss, leaves or other insulating material.

Each pair of distributors is operated by an endless wire cable. All three sets of cables are driven by one six horse-power Otta gasoline engine, which gives the distributors a speed of 38 feet per minute. The change in direction of the distributors is accomplished by means of the reversing lever shown on Plate 4.

The distributors have realized every expectation. Less than two horse-power is required to drive all six distributors. The writer believes that the distribution of the liquid over the bed is more uniform than can be obtained by the methods now in use in this country. The more uniformly the liquid is distributed upon a filter, the greater the quantity of sewage that can be applied to the filter to obtain the same degree of purification; or, with a given quantity of sewage, the more uniform the distribution, the greater the purification.

First Used in Springfield.—To the knowledge of the writer this is the first time that power-driven travelling distributors have been used in this country. The range of temperature at Springfield makes this installation an important one as indicating possible limitations of service in extreme winter weather without covering the filters.

Final Treatment of Filter Effluent

The existing sewer conveys the filter effluent to the final settling basin located near the mouth of the existing sewer. This final settling basin is 150 feet long and 50 feet wide and has a capacity of 150,000 gallons. A reinforced concrete channel admits the sewage to the basin at the upper end and at the lower end a similar channel conveys the settled liquid through a short length of the existing sewer to the outlet into Wilson creek. It has not been deemed necessary to sterilize the effluent.

Sludge Disposal

The sludge which is drawn off from the main settling tanks is conveyed by a concrete trough laid to a grade of 5-16 of 1 per cent. to the sludge beds. The sludge bed, which takes in an area of .35 of an acre, is divided by wooden partitions into twelve units, each unit being 25 feet wide and 50 feet long. Each sludge bed is underdrained with graded gravel 18 inches deep at the center and 12 inches deep at the sides. Down the center of each unit extends a 6-inch vitrified underdrain laid with open joints. The surface of the gravel is covered with a thin course of mortar sand to prevent the sludge from working its way into the gravel. The bed is given a slope of 1 inch in 10 feet away from the sludge inlet to assist in the distribution of the sludge over the entire bed.

Disposal Plant for Northern District

The sewage disposal plant for the northern district is located near Doling Park. It has a capacity of 500,000 gallons in 24 hours and, with the exception of the distribution of the sewage over the filter, is in all respects similar to the plant just described. Instead of mechanical distribution, nozzles are used to distribute the sewage over the beds.

Both plants were efficiently constructed by J. C. & E. T. Likes, contractors, of Des Moines, Iowa, the south plant under very adverse conditions. The south plant was constructed for the sum of $76,063, and the north plant for the sum of $14,795, thus keeping well within the appropriation of $100,000.

The writer's principal assistant, Mr. A. H. Beyer, was in charge of the development of the details. Mr. H. C. Atwater was resident engineer during the entire construction of the plants.

English Road-Testing Machine

A road-testing machine has recently been installed in the National Physical Laboratory at Teddington, England, according to "Good Roads." A circular track 104 ft. long furnished the base for the various types of roads. A horizontal frame, consisting of spokes connecting to eight wheels resting upon the test road surface, completes the apparatus. Each wheel is 3 ft. in diameter and may be fitted with tires of every type known to traffic. The weight carried by a wheel can be varied, as can the speed and the inclination of the wheel to the surface. Other devices for approximating the conditions imposed by climate or weather are provided, and sprinkling of the road surface forms a part of the test. Although but few tests have so far been completed, several definite facts seem to be indicated. Col. R. E. Crompton, consulting engineer of the road board, states that apparently road repairs are necessitated not by surface wear directly but by the displacement of the stones in the body of the road.

The Control of Sidewalk Construction and Maintenance*

By A. Prescott Folwell

IN the early part of this year a member of the society requested the Clearing House to obtain information concerning the methods followed by up-to-date cities in order to avoid the objectionable features of the inspection of sidewalk work by city engineers, and to secure compliance on the part of property owners with the city ordinance requiring them to construct and maintain sidewalks and curbs of standard types. The city engineer making the inquiry said, "The enforcement of the sidewalk ordinance is imposed upon the city engineer and entails an enormous amount of petty detail and annoyance."

Responses were received from forty-five city engineers giving replies to this inquiry. It seems to the author probable that a number of members of the society would be interested in learning what information was obtained by the Clearing House in connection with this subject. Accordingly he has endeavored to give in as brief a form as possible the general tenor of most of the replies.

The methods employed by the several cities may be classified under three heads: First, those in which the city does the entire work, in most cases charging all or part of the cost against the property owner. Second, those in which the matter is left entirely to the property owner, either without any inspection or with only nominal supervision. Third, those in which the contractor is placed under bond. Fourth, those in which the property owner is required to construct sidewalks when ordered, make his own contract for the construction, which construction the city engineer or a similar official is supposed to carefully oversee, and is to a certain extent responsible for.

1. Work Performed by City

Richmond, Indiana, writes: "All work of this kind is done by the city; that is, the city lets the work by contract and exercises careful supervision over it, assessing the cost to the property owner. Only in exceptional cases, where the property owner possesses a long frontage, such as a block, and petitions the city for the privilege of constructing the work by private contract, is such permit granted him, on condition that the work be done according to the standard city specifications and under the inspection of the engineering department."

Asheville, N.C., "lets contracts for this kind of work and employs an inspector, and the property owners pay for same."

In Valdosta, Ga., "all sidewalks are paid for by the city, the work being done under the supervision of the city engineer. Two-thirds of the total cost of this work is assessed against the abutting property." The same is true of Albany, Ga.

In Columbia, S.C., "all sidewalk work is done by contractors employed by the city or by the city's own force, and the work carried on directly under the supervision of this office. We have a competent paving inspector who not only inspects all the sidewalk work being done, but the street paving and other concrete work as well."

In Aberdeen, Washington, and in fact in all the cities of that state, a property owner has no more to do with building his own sidewalks than he has to do with paving the streets. They are both part of the municipal work and are let by contract.

CANADIAN PRACTICE.

In Lethbridge, Alta., "all sidewalks are built under local improvement, the city bearing fifty per cent. of the cost, and the frontages affected, the balance. In view of this, the city lets a contract for all the sidewalks petitioned for and recommended in the early spring, and all the work is done by one contractor working on the designs of the city engineer and under his supervision. The contract thus becomes of sufficient importance to demand the inspection of the city engineer's department, and I would say that we have had no annoyance on account of details of construction."

In Winnipeg, Man., "all sidewalks are laid by the city, or by contractors under city supervision. It is not understood how any other system could be worked to advantage."

In Hamilton, Ont., "the city lays all the sidewalks and curbs, there being no contract work whatever."

In Victoria, B.C., "no private parties are allowed to do any work on the public streets, all sidewalk work being carried out by the department by day labor, and if any special crossings or entrances from the curb line to the property line are required, the department does the work and charges the property owner with the cost."

One city engineer in New York State writes that in his city he believes there are a few more objectionable and disagreeable features than ordinary in connection with the sidewalk work. "I think they would all be eliminated, however, if we might conduct our sidewalk construction in the same manner as we lay a pavement or build a sewer, that is, make a plan and specification and let the contract for a complete job from one end to the other."

A New Jersey engineer also has experienced these difficulties and writes: "I have maintained for several years past that the repairs to sidewalks and curbs should come under the same status as repairs to the roadway and that the cost of such work should be included in the budget for road maintenance. This would make it possible for city engineers to make the necessary repairs at such times and places as in his judgment they are required, without regard to the petitions of the property owners to same. The maintenance cost of work of this kind is a very small fraction of road maintenance and I believe rightfully should be included. In the construction of sidewalks and curbs, I believe they should be given the same consideration as road construction, and should be laid by the municipal authorities and should be assessed against the abutting property. This, of course, applies only where the assessment plan is in operation."

2. No Supervision

Pawtucket, Rhode Island, has no city ordinances covering the subject of sidewalk construction and appreciates the disadvantage of this. It cannot compel a property owner to repair his sidewalk nor charge him with the expense of repairs made by the city. The city furnishes and sets all street curbs, charging the cost of the stone, but not the setting, to the abutting owner. If the owner sees fit to construct a concrete curb in front of his property before the city orders the street curbed, there is no restriction and no inspection of the work.

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*Paper presented before The American Society of Municipal Improvements.

In Norristown, Pa., sidewalks are constructed by the property owner, the only ordinance requirement being that they shall not be of wood or slabs of stone (except flagging) and have a slope of not less than ½ inch to the foot above the top of the curbstone; also, all concrete work done on the public highways shall be constructed according to specifications prepared by the city engineer. The engineer is not supposed to make personal inspection of sidewalks. The entire responsibility for maintenance of sidewalks, including suits for damages for accidents, are left entirely to the property owner.

In Birmingham, Ala., the city engineer furnishes grades and lines for sidewalks on condition that they be built according to city specifications, "but the carrying out of the specifications is a matter of the integrity of the contractor or the watchfulness of the owner, the engineering department being in no way responsible for the quality of the work." Such sidewalks as the city constructs are done by contract under city inspectors.

In Forth Worth, Texas, and probably in other Texas cities, the homestead law does not permit the city to require an owner to construct a walk in front of his premises if this property be all he owns and he resides on the same. All improvements of sidewalk and curb are paid for by the owner and with one or two exceptions the work has been done by private contract in 50 or 100-foot sections, making inspection difficult and costly and the setting of grades and lines particularly so. "I have for a long time been trying to have sidewalks and curbs put down a block at a time, but as yet have, except in a few instances been unable to do so."

In Quebec, "sidewalks are maintained by proprietors and the city reimburses one half of the cost. If they do not keep sidewalks in good order, police constables report them direct to the recorder's courts."

3. Bonding Contractors

In Ames, Iowa, the city council early in the spring lets a contract for all sidewalk work which it may wish to do during the year. Property owners are notified to build sidewalks, and if they refuse to do so, the work is done by the contractor with whom that year's contract has been made. This work is done under city specifications, and no inspection of the job is made, but the contractor is required to put up a bond and then "is left to his honor to do the work according to contract and the specifications. This may appear to be a very loose way, but it has proven so successful in this town that most sidewalks are put in by the city contractor." The engineering department merely gives lines and grade, for this and other street work.

In Decatur, Ill., all contractors are required to give a bond and a three-years' guarantee. If the property owner does the work himself, he is required to give a bond to the city. The engineer only fixes the grade and stakes out the work.

In Kalamazoo, Mich., sidewalk work is done by licensed contractors and are under bond to the city. The inspection is put up to each property owner and he can employ any licensed builder, the engineering department giving grades only to licensed builders.

In Pine Bluff, Ark., when a certain territory requires sidewalks a blank is filled out by the city engineer, signed by the clerk and mayor and served on the property owner by the chief of police. "In regard to handling inspection, I found it a very troublesome and unsatisfactory proceeding but about two years ago I had an ordinance passed placing all sidewalk and concrete contractors under a bond of maintenance to the city in the sum of $1,000 for each and every job of work. Just an ordinary bond for $1,000 with a clause 'to apply to each and every individual contract' had been held legally binding. I also had an ordinance passed requiring a contractor to take out a permit for each job and for this permit a fee of one-half cent per square foot is charged, which amount is ample to pay the salaries of all the necessary inspectors without using any men from the office or regular engineering force." Should the engineer consider the contractor's price too low to give a reasonable profit on good work, an extra inspector is placed on the job. If the contractor is found to be deliberately and consistently doing poor work he is cautioned, and if again found guilty of such conduct he is refused any further permits for sidewalk work.

In Grand Forks, N.D., there is no inspection other than inspection of the work after completion. "The contractors make application at the office for line and grade for each and every piece of walk to be laid. A card index form is used giving lot, block, addition, street, name of owner, name of contractor, date of application, date of survey and completion of work (to be inserted afterwards when same is made), also signature of surveyor. This card serves as an order to the field crew who signs same when the survey is completed. When the work is finally checked, the date of completion and measurement is put down.

"To insure good work we require the contractors to put up a two-year guarantee bond in a sufficient amount to cover a liberal percentage of their work. If in the opinion of the engineer the work is defective at the end of two years it will have to be replaced, not repaired. After two years' trial will say that the system works well, and we get much better results than under the old inspector system."

4. Inspection

In Binghamton, N.Y., two inspectors are employed to look after sidewalk work, but during the rush season it is impossible for them to cover the work and some poor work is done. "My opinion is that the inspection of sidewalks is a farce unless you have enough inspectors so that an inspector can stay with one gang of walk layers the entire season, which would be an expensive method. We now have a proposition which the Department of Public Works is considering putting in force, and that is to put the walks under a two-years' guarantee, label each walk with the date and put the contractor under bond."

In East Orange, N.J., owners are given thirty days in which to repair sidewalks, and on failure to do so the city makes repairs and charges the cost in the next tax bill. The execution of this is in the hands of the city engineer. One street inspector makes occasional rounds and reports walks needing repairs, the city engineer communicates this to council and he is directed by council to have the repairs made. Notices are sent to the property owners and thirty days thereafter a second inspection is made by the inspector, and those not then found in good condition are repaired by the city gang.

In Wilkes-Barre, Pa., sidewalk work is looked after by the commissioner of highways.

In Wilmington, N.C., the city engineer is required to sign a certificate that the lines and grades and specifications have been followed in the construction of the sidewalk in front of his property. If this signature is refused by the city engineer, the owner can refuse payment to the contractor, and the city can rebuild the walk if or whenever it desires and charge the cost to the owner.

In Charleston, S.C., the city pays half the cost of the sidewalks. The city engineer appoints an inspector, whose time is figured in, in calculating the cost of the work.

In Lima, Ohio, sidewalks are constructed under the supervision of the city engineer, under whose direction is an inspector of sidewalks and sewers who is required to see that all sidewalks are constructed according to specifications. As he has supervision over all sewer tamping, is special inspector on the few jobs of sewer construction, looks after the few jobs of sidewalk inspection that the city is doing itself and also inspects construction work being done by private parties, it is self-evident that sufficient inspection of sidewalks could not be given even though he had one assistant. In his latest annual report, the city engineer recommends that a city inspector be appointed for each sidewalk job.

In Indianapolis, Ind., there is "no trouble from this source as, whether work is done under private or public contract, it is done under the supervision and specifications of the city engineer."

The city engineer of Moline, Ill., has nothing but consolation to offer the member making the sidewalk inquiry. "I think all city engineers in the small cities of Illinois are up against about the same condition."

The only reply from Iowa states that "enforcement of the sidewalk ordinance is council's business in Iowa and hence is not attended to."

In Grand Rapids, Michigan, there is an employee under the department of public work known as "sidewalk and pole inspector" "who relieves the engineering department of a considerable amount of work, and a fairly good enforcement of the sidewalk ordinance is secured without undue expense."

At Atchison, Kansas, the enforcement of the sidewalk ordinances is the duty of the street commissioner and, although performed very satisfactorily, is found by him to be a very disagreeable and annoying task.

In Manhattan, Kansas, the engineer is supposed to make a perfect inspection of all sidewalks, but when there is a great deal of work this is found to be impracticable. When enough work is being done to justify an inspector, one is kept going from one job to another, but when sidewalk work is slack, an occasional job is done without any inspection, except such as the property owner may do at the request of the engineer. The engineer tries to have the citizens generally know how many sacks of cement should be used for every 50-foot stretch of sidewalk. As a general thing, the work done has been very satisfactory.

In Holland, Michigan, the city engineer must certify by endorsing the property owner's permit, that the material used and the manner of work done are approved by him and the work has been completed in accordance with his line and grade.

In Fort Smith, Ark., an inspector is employed under the direction of the engineering department to look after sidewalk construction.

In Kansas City, Mo., the city engineer is responsible for the proper construction of all sidewalk work (only concrete sidewalks are permitted) whether this be done by private parties or by public contract. Repairs to construction work are under the supervision of the superintendent of street repairs. All is at expense of abutting property owners.

In San Angelo, Texas, each property owner must take out a permit before constructing a sidewalk, for which the city charges a fee of $2.50 for each 25-foot business lot or each 50-foot residence lot, with a 50 cent charge for each additional lot. Upon presentation of this permit to the city engineer he is required to give the necessary grades and alignment and furnish an inspector to see that all requirements regarding specifications and grades are complied with. Any property owner not complying with this regulation is liable to have to rebuild his curb or sidewalk if it has not been properly constructed.

The Austin, Texas, engineering department has under its direction a special sidewalk inspector whose business it is to see that the work is in compliance with the city specifications and conforms to the engineers lines and grades.

In Santa Barbara, Cal., permits for sidewalk, curb, and gutter work must be taken out by property owners, and inspectors are employed whose sole duty it is to look after this work, which must be done to their satisfaction or it is ordered out.

In comment upon these replies, the author would call especial attention to the arguments in favor of the method first described—that of treating sidewalk work in the same way as roadway work; and this method of treatment should, in his opinion, apply to the designing and general control as well as to the mere construction. By this he means that the material to be used and the time of construction should be determined by the department of highway or city engineer, and that the work should be put in an entire block at a time and not piecemeal.

It seems to us inevitable that most of the highway construction which is performed in small sections scattered over the town cannot receive as effective supervision by the city engineer as could a few contracts each covering an entire block or more. There certainly would seem to be little question that construction in 25 or 50-foot sections must be quite a little more expensive and in many respects less satisfactory than if the entire block were constructed at one time. In addition to this, even where the work is well done, the patchy appearance of a street where old and new sidewalks alternate, and indeed where brick, flag and concrete may all be found on one block and in various stages of repair, is far from pleasing to the eye and is unpleasant for the pedestrian.

The sidewalk is as fully a part of the public highway as is the roadway, so far as its use is concerned. It is as free to the general public and is (or should be) no more used for private purposes by the abutting owner, and we can therefore see no reason why the two should receive different treatment.

As a matter of fact, in too many cases little attention is paid to the sidewalk. Volumes are written about roadway pavements, but only an occasional page about sidewalk paving; but yet to one person who uses the roadway there are probably ten who use the sidewalk. The additional property rights or quasi-owner ship which in some cities are held by the abutting owner over the sidewalk need not interfere with the municipal control any more than they interfere with roadway paving in those states or cities where such ownership is constructed as extending to the center of the highway.

And the logic of the argument would include also maintenance, including street cleaning. In German cities the street cleaning gang cleans the sidewalks as well as the roadway, in many cities flushing them down with hose during the night at the same time that the roadway is similarly treated. In large cities a considerable proportion of the dirt on the sidewalks is blown there from the roadway, and the remainder is carried or thrown there by the public at large which uses the sidewalk (except for store sweepings or other dirt thrown from the abutting premises in violation of the city ordinances). It would therefore seem to be as much the city's business to remove this dirt from the sidewalks as to clean the roadways. An additional argument in favor of this is the fact that the dirt from the sidewalk is very apt to be blown or swept on to the roadway shortly after the latter has been cleaned, thus to some extent undoing the work of the street cleaning gang; which would not have occurred had the entire street from property line to property line been cleaned at one operation.

Considering, however, merely the point of view of the cost of sidewalk construction, there would seem to be little reason to dispute the following statements: First, an improperly constructed sidewalk will be more expensive in the long run in that it must be renewed more frequently than one properly constructed. Second, inspection adequate to securing proper construction is very expensive when the work is done in small jobs of 25 or 50 feet. Third, construction in such small jobs is more expensive to the contractor and consequently to the property owner or city. Fourth, not only would it appear reasonable, but it has been demonstrated by experience, that the lowest prices can be obtained for sidewalk work by letting the contract for the work of an entire season to one or two contractors, with the understanding that no stretch of work of less than a block will be ordered.

Lessons from the International Road Congress

By Col. William D. Sohier, Chairman Massachusetts Highway Commission

THE most important lesson that France teaches us, it seems to me, is that we should secure proper locations for our highways and sufficient width for all future use. Main French highways are 60 feet in width.

The macadam on the national routes is 24 ft. in width; on the departmental roads, 18 ft.; and on most of the other roads, about 15 ft. There is a grass shoulder on each side, about 15 ft. in width.

Most important is that they are spending more than $45,000,000 a year for maintenance on 371,000 miles of road. This is about $125 a mile a year; and we must remember that all of their roads have been built for years and are practically to-day all waterbound macadam roads, where they have not already put in some more permanent form of construction. Their Minister of Public Works is now recommending that $50,000,000 additional be provided to be used during the next ten or twelve years for some bituminous binder on 6,000 miles of the national roads, where it is greatly needed. France has undoubtedly the best road system in the world so far as location, layout, foundation, drainage, etc., are concerned; but where there is much motor vehicle travel—and that is near the cities—their macadam roads are going to pieces just as fast, I think, as our waterbound macadam roads have been since the advent of the motor vehicles. Wherever the motor traffic is heavy I found the macadam roads extremely rough and going into potholes as they are here; but it is only fair to say that this observation would not cover many miles of road in all out of their 371,000 miles, because, especially near Paris, they are already using tar or some bituminous binder, either in construction or as a surface coat.

One noticeable thing in both England and France was that except near the cities one did not meet even 10 per cent. of the number of motor vehicles that one usually encounters here, at any rate in the Eastern States. This accounts for the good condition in which their waterbound macadam roads have remained.

In France, as we all know, they have a patrol system. You still see the piles of stone on the roadside ready to be broken up and put on the road; but in the entire 1,000 miles which I went over, on perhaps only four places—less than ¼ mile each—did I see any dry stone put on the road to fill the holes, and in those instances it was being scattered over the road by the motor vehicles as it is in this country.

They have found it necessary there to use some binder in their patches, and in both France and England I found that they were using tar on their main roads, painting the bottom and painting the stone, and covering with sand, or filling in with stone that was already coated. It was evident to me that in neither France nor England can they maintain waterbound macadam roads where they have more than fifty automobiles a day and still keep them in reasonably good condition without the use of some bituminous material.

Drainage Ditches

Every road that I saw in France had a ditch on each side to carry the drainage. This ditch was usually placed beyond the 15-ft. grass shoulder, and had waterways connecting it.

On almost all of the main roads where there was a grade of 3 per cent. or more they had a shoulder on the side of the macadam and a paved gutter about 4 ft. in width. This was made of larger blocks of stone than ordinary paving stone.

One very noticeable thing, and one that we could well copy, was that the gutter was laid out on almost the same crown as the road, so one could travel on it without any inconvenience.

The crown of the roads there was flatter than ours, not more than ½ in. to the foot, often less. I saw many places in the villages and in the parks near Paris where the gutters were across the road. These gutters were constructed so wide and so shallow that at any reasonable rate of speed (say 15 miles an hour) an automobile could go over them without having anyone inconvenienced, even in the back seat.

In England they have a different road system than that of France. The county boards and county engineers have charge of the main roads outside of villages, though the Government is now helping to improve main roads, and has a competent board of engineers to advise on the kind of improvement to be made.

The central Government has about $5,000,000 a year with which it is helping its counties to make improvements. This, by the way, is secured from a tax of 6 cents a gallon on gasoline, and from the motor vehicle fees, which are extremely large; for instance, in England a 40-h.p. Packard would be taxed about $110 a year.

I should judge that England had on its main roads much more motor traffic than there is in France; although even in England, as far as I went, there was much less motor traffic out in the country than there is in this country, though there is a tremendous motor travel near the cities, particularly in London.

What is particularly noticeable in connection with the English traffic is the tremendous number of traction engines and trailers which one meets everywhere hauling from 8 to 10 tons on iron tires. I understand from their engineers that this kind of traffic will rapidly cut through and destroy any macadam road which is less than 5 in. in depth. So far as I could learn, they are now building most of their heavily travelled main roads of at least 9 in. of macadam, the top 3 in. of which is made of bituminous macadam or a tarred slag.

In and around London they have a very large number of motor buses, which travel on rubber and often go 10 to 25 miles out in the country, with a five-minute service. They are practically like our 6-ton trucks.

The road surfaces there are remarkably good, and they have now about 40,000 miles of road where the surface has been coated with tar. On the whole, I should say that their road surfaces on main roads were much better than those in France, because they have used so much more tar and bituminous macadam. In England and in France they are covering all their tarred surfaces with sand, gravel, or pea stone and dust.

On the other hand, the English layouts are inconceivably bad. Their roads, even on the main lines of travel, are extremely narrow, and the corners very blind. Often there is not room to pass the traction engine that one so frequently meets. I measured several roads where the distance between banks on the road was only 9 to 11 feet.

The surfaces, however, were almost uniformly good, except near the cities, where the motor travel was heavy; and here again the waterbound macadam road was full of holes and rapidly going to pieces when it had not been treated with tar. It is only fair to say, however, that most of them were treated with tar. Right near Hyde Park in London I saw as rough a piece of macadam road as one could find anywhere in this country near any of our cities.

As in France, the whole width of road surface was made suitable for travel from shoulder to shoulder. The drainage was poor. Many times it looked as if the road was going to carry the water from the surrounding country, and would be something more like a drainage canal than a road in a heavy downpour. They have, however, realized the importance of the drainage problem and are rapidly making great improvements.

Maintenance

We can learn a great deal from the English in the matter of maintenance. With a total of more than 150,000 miles of road in England and Wales, they classify as main roads 27,800 miles. The average cost of maintenance of these 27,800 miles of road is $475 per mile per year. About 95,000 miles of road in England are maintained by the local authorities; they are called rural roads. Even on these roads the average amount spent for maintenance per mile per year is $115. Remember that their labor costs much less than in this country.

On 2,173 miles of road maintained by the London authorities (not including the London County Council) the average cost of maintainence is $1,675 per mile per year, or that was the cost some years ago; I am informed it has substantially increased. No wonder they can keep good surfaces.

The engineer in the County of Lancaster, Mr. Schofield, told me that he had more than 600 miles of road to maintain, and that this year he had an average of $1,500 a mile for maintenance. Of course "maintenance" means not only ordinary maintenance, but includes resurfacing and even reconstruction. Mr. Schofield told me that many of his roads had an average of from 50 to 75 traction engines, hauling trailers, going over the road every day. He said they had absolutely destroyed the 6-in. waterbound macadam road and that he was reconstructing his roads with what we would call a Telford base and 9 in. of macadam, with the top 3 in. made of bituminous macadam. To build a road of this character in Massachusetts would cost from $20,000 to $25,000 per mile for a road 18 ft. in width.

In the towns in his county that I went through he was building granite block pavement grouted with cement laid on a 6-in. concrete base.

Resurfacing

In England and France I saw many places where resurfacing was going on. They were uniformly resurfacing with what they called a granite, either Belgian or Welch—what we should really call a trap. What impressed me particularly was that if they resurfaced at all they used what we call a No. 1 stone, at least a 2½ or 3-in. stone, and only about 10 per cent. of the finer stone. This was true wherever they were resurfacing. In France where I saw them resurfacing they were generally using stone alone, but in England they were putting on slag, coated with tar, of this large size, or a 3-in. stone coated with tar. Their method was to lay this stone "one stone deep," roll it slightly, and then roll in ten per cent. of No. 2 and some chips coated with tar. I saw several of these roads, which carried very heavy traffic, that were in very good condition indeed, although three or four years old.

In Liverpool I saw one tar-macadam road built by the "Brodie Method," which is to grout the top 3-in. No. 1 stone when it is rolled with a mixture of equal volume of tar and sand. The sand is heated to the temperature of the tar, the mixture kept agitated and poured evenly into the stone until it flushes to the surface, and then 10 per cent. of No. 2, or finer stone, is rolled in. This road was eleven years old, and still in very good order, whereas a waterbound macadam road, just beyond, carrying the same traffic, had been resurfaced three times in the eleven years and to-day is rougher than the tar macadam.

I was informed that they never close the road in England or France for resurfacing. Personally, I must have gone over at least one hundred places where the roads were being resurfaced, and invariably, whether it was waterbound macadam, tarred macadam or tarred slag, they were repairing one-half of the road only, and left one-half, over which one could pass in reasonable comfort. At four or five places where I inquired I found that they did very short stretches at a time, and at night finished up with a square end. At no place in either England or France could I discern any line in the middle of the road where the joining came.

Character of English Tars

There is still another observation I would like to record, and that is that the tars in England seemed very much more lasting, more elastic and more sticky than ours. I saw only 1 mile of road in all where the tar surface seemed to be picking up—in other words, where the stone showed below it; and in that instance it would undoubtedly be patched at once and before a pothole came. With that one exception, their tar surfaces were practically perfect. There were no potholes, and when one dug into the tar it always seemed alive, sticky and soft.

On only a very few miles of road was there any of that mosaic effect that we had been told about. The engineers told me that that effect came the first year when they had used only, say 1/6 gal. of tar per square yard, and where it had worn off on the tops of the stone; but when they received a second application, with sand covering, it made a blanket coat similar to one we have in this country.

In Massachusetts we find we can maintain our oil and tar surfaces most economically by having a team and three men constantly patching from 6 to 8, or even 10 miles of road. If this work is well done we never have any holes.

Another important consideration was that in both England and France all roadwork is in charge of competent, trained engineers, who not only have technical training but many years of practical experience. They stay in office as long as they are competent and efficient; it is not a matter of politics. They have entire charge of roadbuilding and road repairs, and employ efficient foremen and workmen. These facts largely account for the results obtained.

Another most valuable lesson that our cities could learn from the practice in most of the cities abroad is to leave street surfaces alone after they are built. When this is impossible and the street has to be dug up, the street department relays the pavement or surface and collects the expense of putting the surface into good condition again and maintaining it for a reasonable period of time. Water pipes, local sewers, gas, electric conduits, etc., should be so located that they can be connected with the buildings without disturbing an expensive street pavement. It is no unusual sight in my State to see a street dug up two or three times in one year, and it is hardly ever properly repaired. In consequence, paved streets that would have remained in good condition twenty to forty years have to be reconstructed in five or ten years at enormous cost. In the meantime they are in wretched condition. The time has come, in my opinion, when no one should be allowed to dig up our roads and streets anywhere, no matter how influential the corporation or individual may be, without having to pay to the department in charge of the road enough money to put the street back to its former condition.

Owing to the slight sinking of a corner of the McGill Union, Montreal, the Foundation Company were hurriedly called in, and have underpinned the corner. The foundation of this particular portion of the building is supported on piles.

Brick Road Construction*

By James M. McCleary, Road Engineer, Cuyahoga County, Ohio

THE chief purpose of rolling the sub-base is accomplished when the weak or spouty places in the soil are revealed, so that the engineer can treat them as he sees fit. For this purpose a roller weighing from 8 to 10 tons answers every requirement. Preceding the final preparation of the sub-base the curbs must be placed. In case of most of our rural work curbs are placed flush with the surface of the completed pavement.

With curb set and base prepared the next step is the placing of the concrete base, which with our roads has been 4 in. in depth. In specifying the proportions a mixture of 1:3:5 with a permissible variation according to the size of the aggregates which will most nearly fill the voids meets every necessity.

In laying the brick, first see that the lugs are turned one way. Next make certain that the joints are broken so that one-third or more of the brick of one course overlaps the brick of the next course. Third, be sure that every fourth course is driven up to a straight line. Finally, for the sake of appearance, keep the line of the brick at right angles with the curb.

Care should be taken to see that all soft brick or brick that are burned too hard are removed. Those so heavily kiln-marked that they will cause unevenness in the pavement should be turned. Caution should be exercised in this, for many a kiln marked brick is thrown out which if allowed to remain would have been of more value to the pavement than others that are retained.

Use of Roller

After the brick are thus placed in the street their slight unevenness should be ironed out by the use of a roller not exceeding 5 tons in weight. If a horse roller is used at all, it should have a diameter of at least 5 ft. Rolling should begin on one side and pursue a course parallel to the curb. This should continue until the center of the pavement has been reached, when the roller should be moved to the opposite curb and rolling repeated.

For grouting joints use a grout filler composed of equal parts of sand and cement. The grout should be mixed in a watertight box with a "lower corner," using not more than 1 cu. ft. of sand and one bag of cement, mixing the mass until it assumes a uniform color. Add water and stir the mixture until it assumes the consistency of thin cream. The mixture should then be applied to the pavement by means of scoop shovels and thoroughly swept into the joints. After sufficient time for setting has elapsed a second coat, slightly thicker, should be applied, and later a third coat, which will assure filled joints. The last coat should be worked either with a specially prepared broom or a rubber squeegee and swept across the joints at an angle of 45 deg.

After the initial set has taken place the pavement should be covered with ½ in. or more of sand and this kept saturated with water for at least five days. The pavement should not be opened to traffic for at least ten days.

To counteract expansion and contraction we have relied mainly on the ability of our structure to prevent moisture from getting underneath the roadway and upon an endeavor to have our cement filler at the greatest possible strength. These provisions, together with a rigid curb, enable us to hold in compression the expansion occurring in our narrow roadways. A few cracks in the pavement have appeared, but have not ravelled out so as to injure the traffic worth of the road, and have not been thought of sufficient importance to require repairs.

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* Road Congress paper abstracted by The Engineering Record.

The facts that our roads are in shape for maximum service twelve months in the year, that they originate no dust, and that washing by rain suffices to keep them clean have so impressed the taxpayers that, although we have built nearly 400 miles of such road, thirty-three farmers' petitions are now on file in our office asking for thirty-three separate extensions.

Harbour Projections and their Effect Upon the Travel of Sand and Shingle

AMONG the readers of papers at the meeting of the British Association at Birmingham was Mr. Ernest R. Matthews, borough engineer of Bridlington, who dealt with the subject of harbour projections and their effect upon the travel of sand and shingle.

Mr. Matthews pointed out that any seaward projection on the coast, whether it were in the form of a groyne extending merely to low water of ordinary tides or low water of ordinary spring tides, a breakwater, a harbour arm projecting 1,000 ft. or more, or a promontory such as Flamborough Head or Spurn, extending seaward some miles, had the effect of arresting, more or less, according to the magnitude of the projection, the travel of the sand and shingle on such coast. In the case of harbour projections run out at right angles to the coast line, this obstruction, especially on a sandy coast, impounded the travelling material on one side of the harbour, and often caused alarming erosion on the other. He gave excellent examples of this in the case of Yarmouth, Shoreham, Lowestoft and Madras harbours, at each of which millions of tons of sand (except in the case of Shoreham, where it is shingle), representing acres in area, were being held up by the harbour piers. The sea front at Yarmouth might be said to have extended seaward during the past half century an average of 300 ft., due almost entirely to the construction of the harbour; while at Madras 650,000,000 cu. ft. of sand had accreted on the south side of the harbour within a distance of 3 miles of the harbour, and 450,000,000 cu. ft. of land has been eroded on the north side within a similar distance, and the authorities there were now contemplating an extension of the harbour seaward at an estimated cost of about £3,000,000. It was considered necessary to do this in order to reduce the extent of the silting up of the harbour. The author referred to the Newhaven, Bridlington and Whitby harbours, and that at Hastings, which is only partially constructed, and described their effect upon the coast. He also described the effect upon the coast of headlands which ran out at approximately right angles with the coast, and those which formed an obtuse angle with the coast.

The question would naturally be asked: What was the remedy or partial remedy for this trapping of the travelling sand and corresponding erosion on the leeward side of a harbour? Previously the only method of escaping from the impounded material seemed to have been in periodically extending the arm of the harbour further seaward as proposed at Madras. This meant a tremendous cost, and the results were often not satisfactory, for as the pier advanced the shore also advanced. It had been suggested that instead of doing this openings should be left through the shore ends of the harbour arms for the sand to pass through, but this suggestion was not practicable, for immediately the travelling material passed through the openings the wave behind it did not possess sufficient force to move the material through, especially where the width of the harbour was considerable.

Mr. Matthews suggested that, in order to modify this trapping of the sand, the ground plan of a harbour, instead of showing the piers running out at right angles to the coast, or approximately so, as was the usual custom, should, on the side facing the direction of the travelling material, project from the coast at an angle of 45 deg., and the additional area thereby enclosed by the harbour piers could be utilised, among other purposes, for that of wharfage. The travelling material would pass around the harbour projection if the plan of the harbour were on those lines, and would supply the coast on the lee side of the harbour with a natural protection of sand and shingle.

The reader of the paper illustrated the various points referred to by numerous diagrams, photographs and lantern slides, and stated that, in arriving at his conclusions he had carried out numerous experiments —he described in the paper—in which he was assisted by the deputy mayor of Bridlington, Mr. Councillor S. Charlesworth. He made the suggestion that where it could be proved that erosion had occurred, and was still taking place, owing to the projection of harbour piers, or the lengthening of such piers, or the construction of a spur breakwater from such piers, the harbour authorities should be called upon to contribute towards the cost of the protection of such a coast as far as the affected area was concerned. He also suggested that in the granting of powers by Parliament for the construction of new harbours it should be made compulsory that contributions should be made towards the cost of the prevention of erosion where it was proved that protection works were necessary in consequence of such harbour projections.

Two-Course Concrete Pavement Work

In a communication on top course work on concrete floors in the Engineering Record, Charles H. Johnson, Supt. Public Works Dept., Guantanmo, Cuba, writes in part as follows:

"From personal observation of several hundred jobs I think that most, if not all, of the cases of the top coat separating from the base are caused by putting in the base too dry, allowing the base to set before applying the top, getting sand or other foreign matter on the base before applying the top, thus ruining the bond between the two layers, and finally making a sand joint in the base and not cutting the top through.

"The writer laid about 3,500 lin. ft. of concrete road from 8 to 12 ft. wide with 1:3:6 base and 1:2 sand top, and had absolutely no trouble with it. This was laid in sections 30 ft. long, with a 1-in. cypress expansion strip every 30 ft. Six months after laying there was no sign whatever of any separation between base and top.

"On this job the base was laid very wet and put into place with a shovel, no tamping whatever being done. The top was often laid not more than fifteen minutes after the base was placed, and was also very wet. It was floated with a wooden float as soon as possible and then covered with 1 or 2 inches of sand, which was left on for at least a week, and frequently wet."

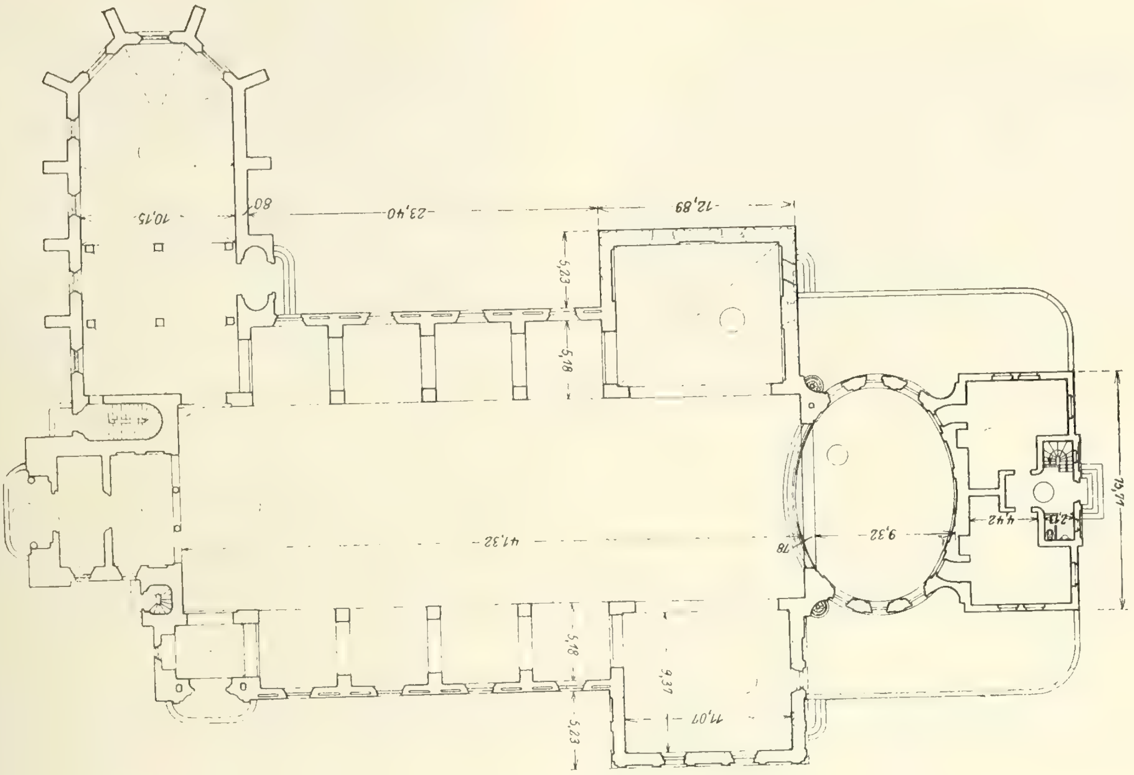

Fig. 1.—Plan.

Plan and Longitudinal Section
of
St. Magdalen Church, Strassburg

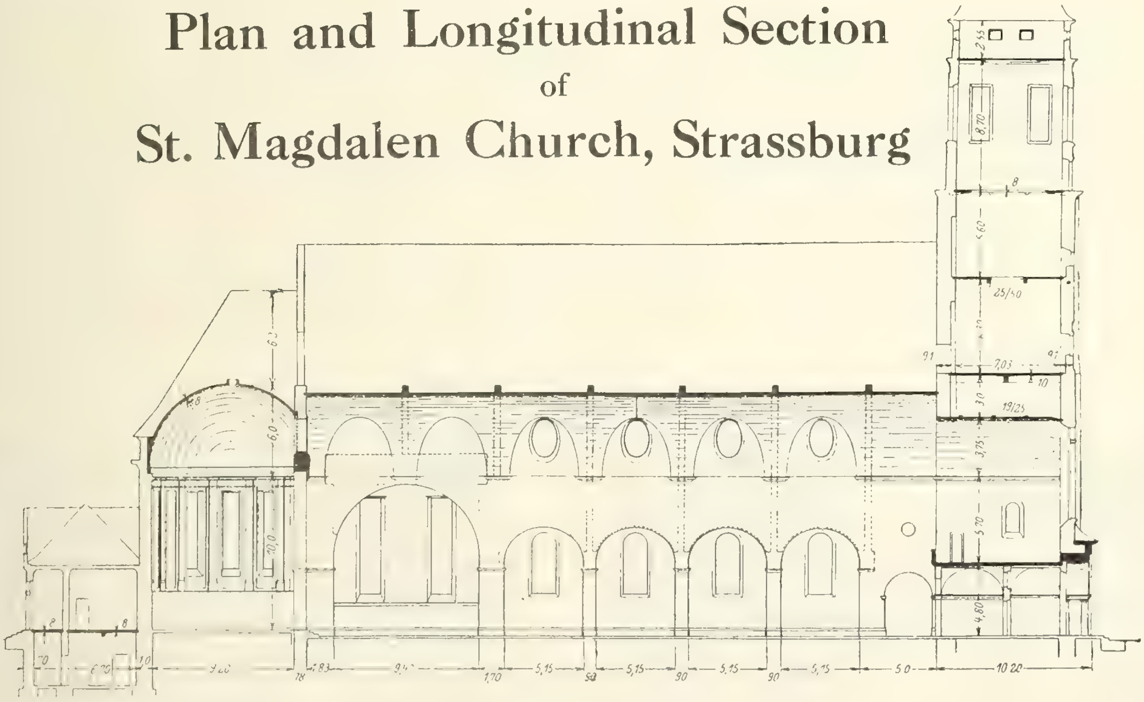

Fig. 2.—Longitudinal section.

A CHURCH IN REINFORCED CONCRETE

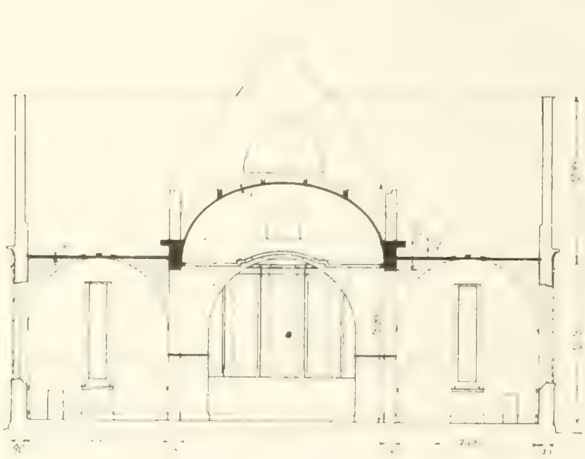

Fig. 3.—Section through cross nave.

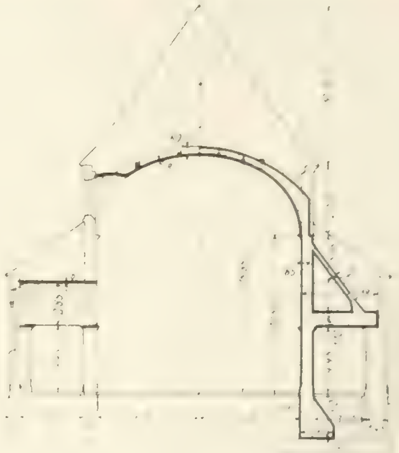

Fig. 4.—Cross section.

A Church in Reinforced Concrete

By V. J. Elmont, B.Sc., A.M.Can.Soc.C.E., Montreal

THE employment of reinforced concrete in church building has increased rapidly during the last ten or fifteen years. Though there is still only one church—so far as I am aware—built entirely in that material, namely the Cathedral of St. John and St. Mary, Manila, Philippine Islands, there are numerous churches in which some part of the structure is built in reinforced concrete.

Not infrequently when a church, in which wood has been used extensively, burns down, the new church, erected in the same place, is made fireproof by adopting reinforced concrete as the material for the vaults, domes, floors, stairs, roof trusses, etc. This is the case with the St. Magdalen Church, in Strassburg, which was destroyed by fire some years ago. The new structure has been completed recently. It has a main nave (Fig. 1) 44 ft. 4 in. wide and 135 ft. 4 in. long and a cross nave 36 ft. 4 in. wide. The choir is elliptic in plan, the axes of the ellipse being 50 ft. 9 in. and 36 ft. 1 in.

All the floors and vaults are in reinforced concrete. The main nave is covered by a barrel vault, running through from tower to choir (Figs. 2, 5 and 6). The 2½-in. thick slab of the vault is supported by four longitudinal beams (Figs. 3 and 5), which again rest on five arch girders, spaced 19 ft. 10 in. center to center. The load due to the roof and the wooden roof trusses is also carried over to these girders.

In the cross-section on Fig. 4 there is shown, diagrammatically, the design of the arch girders. These are built in one with a triangular frame, one each side, supported by two rows of columns, the inner one being of reinforced concrete and the outer of brick. The foundation for the reinforced concrete columns is also built of that material, the dimensions being figured out to keep the pressure on the soil within the allowable limit for the most dangerous combination of horizontal and vertical forces.

The depth of the arch girders at the crown is 2 ft. and at the springing lines 2 ft. 2 in., the width being 16 in. The reinforcing bars at the crown are five plain round bars ¾ in. diameter by 2⅞ in. diameter, both

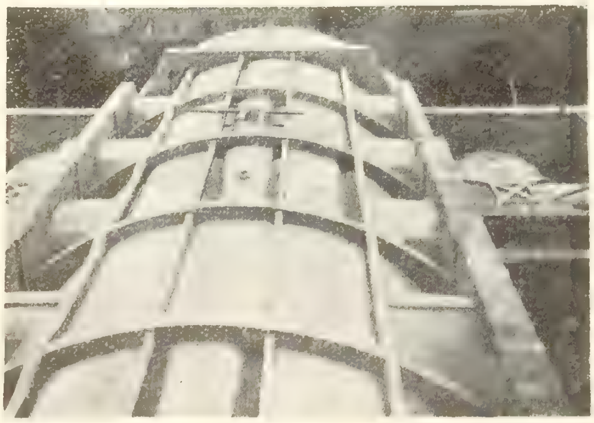

Fig. 5.—Vault over main nave.

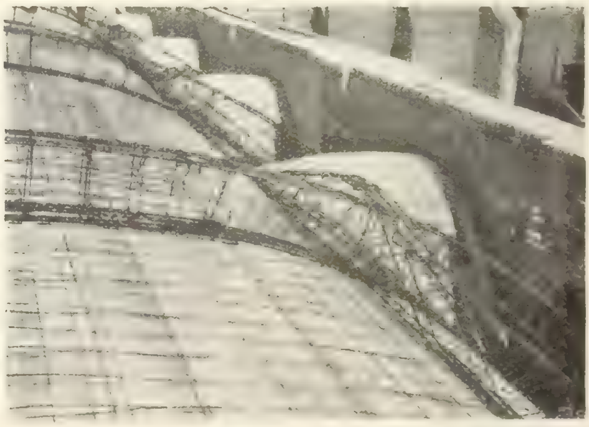

Fig. 6.—Reinforcement of mainvault.

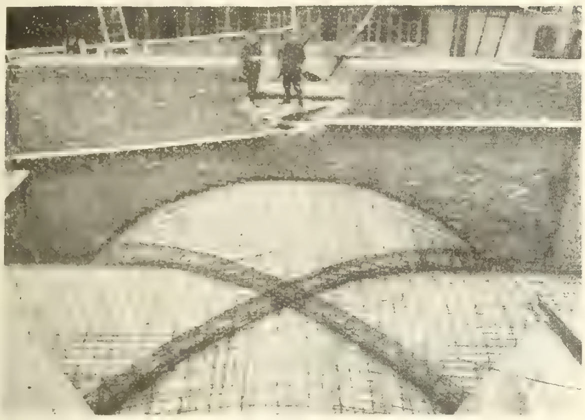

Fig. 7.—Reinforcement of vault over cross nave.

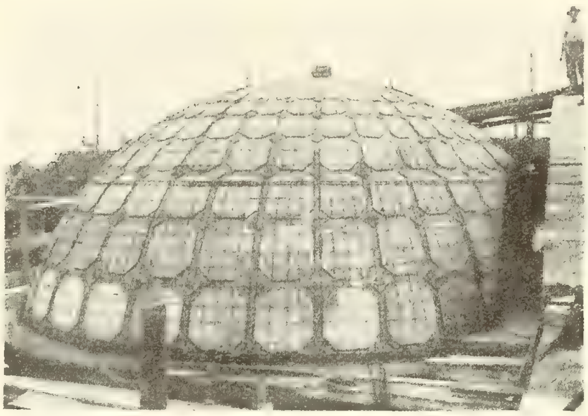

Fig. 8.—Dome over choir.

at the intrados and extrados, at the springing lines eight ¾-in. diam. bars at both sides. Between the second and third arch girder the vault has an expansion joint. The longitudinal beams are therefore designed as cantilevers in this bay.

The two portions of the cross nave are covered with vaults, each having an area of 36 ft. 4 in. by 30 ft. 7 in. The diagonal ribs (Fig. 7), have a width of 10 in. and are 2 ft. 8 in. deep at the crown and 1 ft. 10 in. at the springing lines. The reinforcement is four ½-in. diam. bars in both sides.

The slab forming the dome over the choir (Figs. 2 and 3) is 3-in. deep at the horizontal and vertical ribs, but only 2½ between them. The horizontal ¼-in. diam. bars have a spacing of 10 in. to 12 in. at the crown and of 2 ft. 8 in. to 3 ft. 4 in. at the springing lines. The area of the vertical bars is also diminished toward the crown. A ring of three bars ⅝ in. diam. is arranged at the springing line and half way up is a similar ring of two ½-in. diam. bars.

The barrel vaults over the side naves have a span of 16 ft. 10 in. by 3 in. thickness.

Proposed New Machinery Hall for the Canadian National Exhibition

By W. Almon Hare, B. A. Sc.*

THE consensus of opinion among machinery men and others vitally interested in the welfare of the Canadian National Exhibition is that there should be an entirely new Machinery Hall, and on a new location in the grounds, for the proper display of machinery of different kinds, so as to bring before the public a more correct understanding of the importance of the many and varied industries established for its production in Canada. With this in view the following is an outline of some of the ideas which have occurred to the writer, and which may accelerate the movement toward the establishment of better facilities.

The present location, owing to the recent lowering of the Grand Trunk tracks to the north, has made it impossible to switch a car into the building. Obviously it will be an important feature in the new location that this facility is well provided for. The material to be exhibited is all of a heavy nature, and can be economically handled in only one way; that is, by bringing the railway cars into the building and by having proper crane facilities to lift the machinery and to place it in any part of the Hall.

The accompanying proposal represents a design that, in the writer's opinion, would not be any too large, considering the number of firms who would avail themselves of the opportunity to exhibit, if the proper facilities were provided. The design is for a steel building 600 ft. long by 125 ft. wide. It should be constructed in two bays each 600 ft. by 62½ ft., thus providing opportunity for the erection of a 10-ton and 15-ton motor electric travelling crane, each with a nominal span of 60 feet and running the entire length of the Hall. If the railway tracks are brought into the building on a line at right angles to the length, the cranes will pass directly over the cars, and will thus give all necessary facilities for the rapid and economical loading and unloading of heavy machinery. If the commissioners cannot see their way clear to erect the whole building as illustrated, the ground should be secured and held in view of an extension by adding length only, so as not to call for the erection of a third crane.

As a great number of exhibitors have apparatus that requires either steam or compressed air for operation, it is suggested that a conduit 5 or 6 feet wide be laid all around the inside walls below the floor line, with two cross connections from side to side. In this conduit would be placed the high-pressure and exhaust line for steam and water service; gas pipe; low-tension a.c. and 250-volt d.c. wires, together with the compressed air pipe line. A drainage system would also be required. These pipes and wires would be provided with tapping stations every 75 ft. or so, with branch connections to each booth. Doubtless the compressed air would be provided without charge by the exhibitors of steam or electrically driven air compressors. While the steam and electrical current would be provided by the C. N. E. power station, which should be erected adjoining Machinery Hall.

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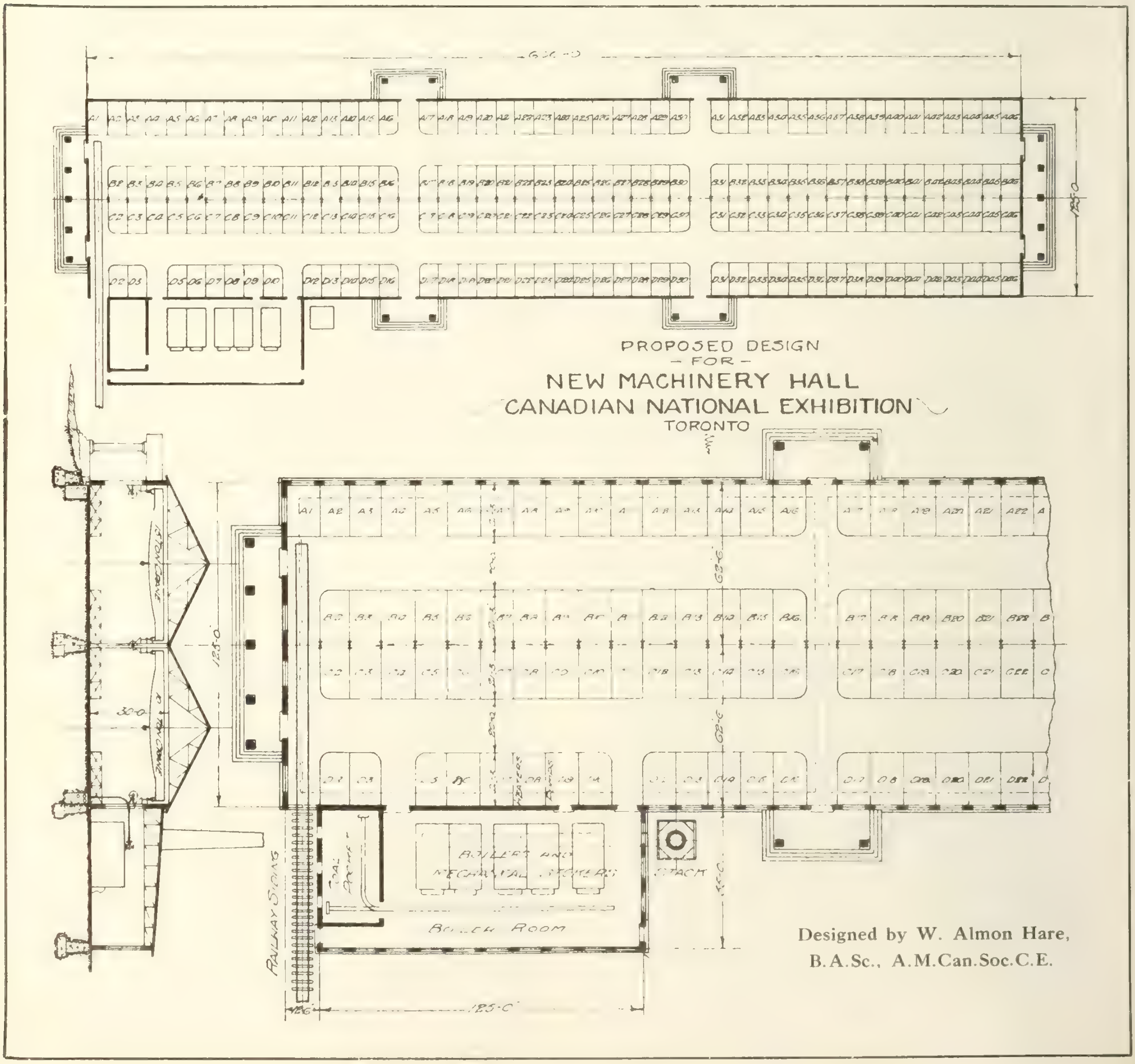
*President, The Hare Engineering Company, Toronto.

This power station should be designed to carry the entire Machinery Hall load. This would obviously require quite a modern steam boiler plant with stack and mechanical stokers. It could not be done without considerable expenditure, but it will be impossible to get exhibitors of steam apparatus unless they are given facilities to operate their equipment.

For the operation of the equipment that does not call for steam, electricity or gas, lines of shafting should be provided on both side-wall columns as well as on the centre columns. This shafting should be operated by motors mounted on brackets, out of the way, and geared to the shafting by chain-drives, so as to secure close centres. This shafting should have frictionless bearings, and would be available for all small apparatus to be operated only by belt.

Doubtless this is an undertaking which should be in the hands of a consulting engineer, who has made a specialty of factory construction. After the general layout has been decided, it would be in order to have an architect beautify the exterior to conform to the general scheme of the other buildings, provided no alterations were permitted with the details inside the building. It is important that no secondary consideration, such as questions of cost, exterior appearance, etc., should be allowed to interfere with the carrying out of the scheme in the best possible way. The idea is to provide that which is absolutely necessary to properly represent this tremendous branch of industry. The general public has no idea as to the importance of the part that machinery plays in our national development, and if facilities are provided along lines similar to those suggested above there will be no parties more surprised at the resulting exhibition in the new Machinery Hall than the directors themselves.

In conclusion, the writer feels that attention should be drawn to the possible future of Toronto as a general machinery market in Canada, and the influence of the new Machinery Hall on bringing this to pass. The completion of the Welland and Sault Ste. Marie canals and the enlargement of the St. Lawrence canal, with the new harbor facilities in Toronto, will cause this



PROPOSED DESIGN
— FOR —
NEW MACHINERY HALL
CANADIAN NATIONAL EXHIBITION
TORONTO

Designed by W. Almon Hare,
B.A.Sc., A.M.Can.Soc.C.E.

city to be the great distributing point for material of this kind in Canada, to a much greater degree than ever before.

Ontario is the best market for machinery of all kinds at the present time, and Toronto is the natural centre of supply, but with these added shipping facilities Toronto houses will be better able to ship to all destinations, and this will assist materially in the development of the city. The size and importance of the exhibits that will come to the new Hall, once the facilities are provided and fully advertised, will make this city a buying centre for the whole country. American and European firms who wish to establish themselves in Canada will make large displays, while Canadian producers will not be found behind their competitors.

The facilities above outlined will be found of great assistance in bringing to the city conventions of American and Canadian associations of all mechanical trades, and this will assist in extending the influence of the new Machinery Hall beyond that of the term of the Canadian National Exhibition itself.

Reinforced Concrete in Factory Construction

By Alexis Saurbrey, M. Am. Soc. C. E.[*]

THERE are no special difficulties in the problems encountered by the engineer in the construction of factory buildings. The essential requirements are: 1, adequate strength; 2, fireproof construction; 3, plenty of light; 4, sanitary conditions; 5, reasonable cost.

From the point of view of the engineer, all of these are of equal importance. The owner, perhaps, is somewhat prejudiced in giving too much weight to the last item on the list, the cost—but it can usually be shown that the other four are of as great financial importance as the first cost, and sometimes greater.

1. Adequate Strength.—This question is of a purely engineering nature and needs only to be touched upon briefly in this place. The floor loads in most factories are usually small from the engineer's point of view, and the machinery light, and there is no trouble whatever in avoiding vibrations and noises. Of course, it will be necessary to make the floors of the stock rooms and shipping rooms stronger than the manufacturing spaces, but it is safe to say that the average factory will ever carry such weights on the floors as will, for instance, machine shops, foundries, or grain elevators, of which many have been built of reinforced concrete throughout this country.

2. Fireproof Construction.—It is true that no known building material (except asbestos) will survive a hot fire of long duration. Nevertheless, concrete has a far better endurance than any other commercially feasible material, be it bricks, hollow tile, or plaster, and the proof of this statement is found in numerous experiments conducted by the U. S. Government, and various Boards of Underwriters, if indeed actual service tests were not sufficient to dispel all doubt upon the subject. For instance, the Bayonne (N. J.) plant of the Pacific Coast Borax Company, built in 1898, went through an exceptionally hot fire in 1902. Yet, the damage to the reinforced concrete floors and walls was repaired for less than one thousand dollars, and this damage largely occurred through the fall of various heavy tanks, etc., supported temporarily on wooden trestles, which were destroyed in the fire.

Many owners take advantage of this fact and carry no insurance on the building itself. The contents, of course, should be insured, for even if the building itself is fireproof, a fire once started will consume all combustible materials within reach, if not put out. But according to Mr. L. H. Kunhardt, vice-president, Boston Manufacturers' Mutual Fire Insurance Company, the insurance rate on both building and contents is reduced.

3. Plenty of Light.

4. Sanitary Conditions.—A reinforced concrete building is in itself a sanitary building. It has no pockets for dirt, it might be daily or weekly flushed with water without any injury; there is no wood to decay or rot, no possibility for vermin.

The Foster Armstrong Company, one of the clients of the company with which the writer is connected, have informed us that their buildings require much less fuel for heating than anticipated—and they have, all told, more than a dozen large buildings of reinforced concrete, used for the manufacture of high-grade pianos.

The diffused daylight, admitted through the large windows, and reflected by the light-colored ceilings, makes the buildings of this kind cheerful even in winter, which again results in increased output per man. Light is the great moving power behind the human machine, and can be had for nothing if we only give it admission. Light drives away the germs and makes the workmen healthy and efficient, and light is the best safeguard against accidents. A reinforced concrete building can be designed so as to give a maximum of light on all sides.

5. Reasonable Cost.—The owner will here consider two items: The first investment of which he must pay the same interest yearly, and the upkeep, which is nothing for the first year or years, and then in most types of buildings, after a certain interval, it will grow fast each year, or, if not taken care of properly, it will cause the building to deteriorate rapidly. The only wear in a reinforced concrete building is in the cement surface of the floor, and where this is properly laid, to begin with, it will give perfect satisfaction for years. The Ransome people have been constructing wearing surfaces of cement for thirty-seven years, and have never been called upton to replace any worn-out cement finished floors.

Compare this record with the known facts in other types of construction: rusting of iron, replacing of worn-out wooden floors, gradual sagging and failure of overstressed joints and girders; ravages of dry rot and the hundred and odd other kinds of rot, and, finally the tremendous annual fire loss.

If then, the maintenance of a reinforced concrete building is nil compared with that of other types, the first cost is also very favorable. A first class reinforced concrete building is cheaper than any other type of FIREPROOF building by about 15 per cent. up. It has been known to compete successfully with a first class mill constructed building but where lumber is cheap, and other conditions are in favor of brick and timber work, the reinforced concrete building may sometimes cost ten to fifteen per cent. more than the combustible, or non-fireproof building. Here again, recent innovations have materially lowered the cost of the standard reinforced concrete building. Thus, the recent additions to the United Shoe Machinery Company's buildings were built under the Ransome Unit System at a materially lower cost per square foot than the older buildings of similar appearance but erected according to the usual methods.

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[*] Chief Engineer, Sansome Engineering Company, New York.

While the true cost of any given building can be determined only by careful estimates, based upon loyal conditions as to cost of labor and materials, loads to be carried, and character of the available soil upon which the foundations must be placed, we may perhaps say that a reinforced concrete building complete but exclusive of machinery, will cost approximately 6 to 8 cents per cubic foot, with a probable reduction of about one cent per cubic foot in case improved methods are used.

It takes men of a peculiar kind to build well and economically. Owners have sometimes been disappointed with their buildings of whatever type selected, and as this is usually the owner's own fault, if we go deep enough, it might perhaps be well to speak briefly of the best methods of getting a good factory. The owner must have 1, good plans; 2 good work.

It is the duty of the engineer to procure these two. It is the duty of the owner to meet his obligations promptly. Even if both owner and contractor do their best to pull together, disputes of an entirely innocent nature may arise, in which case the engineer has the additional duty of acting as judge between owner and contractor.

Under this arrangement both owner and contractor are usually bound by the engineer's decision without recourse. In other cases, where mutual confidence exists between owner and contractor, the architect or engineer is dispensed with, and the contractor does all the planning.

1. **Good Plans.**—However skillful the engineer may be, on questions relating to the best way of putting the building together, the proper man to plan a factory layout is the one who has to use it, that is, the manager of the plant. In some special lines of manufacture, the makers of the machinery are better posted on the best arrangement, in other lines special mill engineers are the best men. But in any case the best man to design the reinforced concrete work is a reinforced concrete expert and no mill engineer, or manufacturers' manager should attempt to do what the structural specialist can do better and cheaper. Many essential features of reinforced concrete buildings are subject to patent royalties, of which only the specialist is aware. When the plans have been thus prepared by the specialist, and work started, no further changes should be made. While changes during the erection can be made in a reinforced concrete building better than in any other, changes are nevertheless the great bugbear of building construction and will break up the best organization.

2. **Good Work.**—One essential pecularity of reinforced concrete is that it is manufactured right where it is to be used, while steel, timber, brick, etc., are brought to the building more or less ready for assembling, except possibly for a few finishing touches. Special ability is therefore required on a concrete job, and only firms of old and established standing should be entrusted with the work. In that case, there would naturally be that mutual confidence to which reference has been made above so that the owner would not hesitate at giving the contract out of the so-called cost plus profit basis. In that case, the contractor is certain of a reasonable profit on his work, while the owner pays only for what he actually gets in materials or service, plus the stipulated profit. In this way, contracting is placed on a sound and equitable basis, and the gambling feature is eliminated.

Where, on the other hand, bids are asked for promiscuously, and the contract awarded to the low bidder, the work is almost certain to go to a man who is bidding low, not on account of his excellent methods of handling this kind of work, but on account of his lack of ability and knowledge. Quite often such contracts end in litigation and troubles of all kinds. It rests with the owners in general whether or not the work is to be creditable, and whatever form of contract is entered into, it is essential that the work be given to people who really know their business.

It is true that inspection of the building will do much to eliminate bad work, and the owner would therefore do well in having a competent, tactful engineer to represent his interest on all work of importance. There are many engineers who make a business of such inspection, and their employment will in most cases result in satisfaction to both owner and contractor if the man is of the right kind.

Mr. R. F. Uniacke on Transcontinental Construction

Mr. R. F. Uniacke, bridge engineer of the Grand Trunk Pacific, at a meeting of the Canadian Railway Club, described some of the difficulties of the construction work, particularly of bridges, on the eastern section of the Transcontinental, from Winnipeg to Moncton. There are 220 bridges—aggregating 11 miles—on this section, the cost being about 6 million dollars. Concrete was largely employed in constructing the piers and abutments, and said Mr. Uniacke, this material might well be called the spirit of the Transcontinental. Without concrete, he added, the work of building the line, depending on stone masons, could not have been done in 25 years. Typical bridges were shown on a screen and their characteristics described, while instances were given of initial failures owing to unsuitable sub-soil and other causes. Work went on summer and winter, sometimes with the temperature 30 deg. below zero. The rails were now joined from Moncton to Winnipeg, with the exception of the crossing of the St. Lawrence at Quebec, which awaited the completion of the bridge.

In the meantime a car ferry was being built in England by Cammell, Laird & Company. There were difficulties to be overcome in ferrying trains across the St. Lawrence, owing to the flow of ice, and the rise and fall of the tide. The result was that water froze on the side of the docks, the ice being sometimes eight and nine feet thick. Mr. Cowie, the Montreal harbour engineer, was consulted, and he designed a ferry with a tidal deck, and with an "apron" at each end, which joined the rails of the boat with those of the docks, without the ferry having to touch the dock. The cost is £115,000, and the ferry will be in operation in May next.

Mr. Uniacke spoke of the difficulties of getting supplies to the scene of operations, and stated that dogs played an important part in taking up the goods to the various parts of the country.

The Channel Tunnel—A Project of International Interest

THE project of a tunnel under the English Channel, connecting England and France, has been engaging considerable attention of late. The scheme is no longer regarded as hare-brained, or mythical, as is evidenced by the careful reply which the British Prime Minister gave to a deputation representing all sections of the House of Commons which waited upon him recently to urge the great benefits that the tunnel would confer upon commerce between England and the continent. The Prime Minister, the Rt. Hon. Mr. Asquith, explained the policy of the government in rejecting previous proposals—a policy founded largely upon military considerations—but expressed willingness to hear further arguments in favor of the project, and promised careful consideration by the Imperial Defence Committee, whose decision is awaited with interest.

The construction of this tunnel would provide one of the most interesting engineering works of a century. It may not generally be known that more than four thousand yards of tunnelling have been done at a cost of $1,250,000; that thousands of soundings have been taken from shore to shore, and that all the elements are at hand to enable work to be resumed promptly and carried to a successful issue.

The total cost of the whole undertaking, including the purchase of land and rights on the English and French coasts, is estimated at $80,000,000, which would be contributed equally by English and French companies.

Our remarks are introductory to an extract given below, from an interesting paper read last month at the First Annual Congress of the Franco-British Travel Union in London by Sir Francis Fox:

In 1876 and 1877 the French geologists, Messrs. Potier and Lapparent, took 7,600 samples of the bottom of the Channel, 3,267 of which they were able to utilise. The grey chalk through which the tunnels would be bored, if the scheme were sanctioned by his Majesty's Government, was 87 ft. thick at Dover and 70 ft. thick at Sangatte. It was excellent material in which to work, possessing the peculiar property of gradually "puddling" itself, and becoming impervious. Containing no flints, it was, as far as could be ascertained, free from fissures and slides; but should a fissure be encountered, it could be easily and satisfactorily dealt with by means of the system of high-pressure grouting which had been introduced within the last five or six years. In the Mersey Tunnel, his own firm, Sir Douglas Fox and Partners, had met fissures with which they had thus dealt successfully.

A drainage heading would be driven from each side of the Channel, rising towards the centre, and connected at Dover and Sangatte with shafts for pumping and widening. The main tunnels would consist of two single-track circular tunnels, each of 18 ft. net internal diameter, and thus large enough to accommodate the rolling stock of the British and French main lines, except only their locomotives, for which would be substituted electrical locomotives of ample power to deal with the heaviest trains running upon the main lines. At frequent intervals these tunnels would be connected by cross passages with air tight doors, rendering it easy to introduce currents of air, and to exchange workmen from one tunnel to the other. Including the junctions with the main lines of railway in England and France, the total length of each tunnel would be 31 miles, the actual length under water being 24 miles. The tunnels would be placed 36 ft. apart, and lined throughout by cast iron segments, of ample strength to resist any possible pressure, and grouted on the outside so as to secure a covering of cement which would not only prevent leakage into the tunnels, but also preserve the plates from corrosion.

Assuming that 17 yards per day could be excavated for six days per week, the annual progress would be about three miles at each face, so that the driving of the drainage heading would occupy four years. Three shifts of men would have to be employed, and the changing would take place below and on the spot, no stoppage of work being allowed. This was the system adopted in the case of the Simplon Tunnel, where the drills never stopped while the shifts were changing. An emergency door would always be kept in position near the "face" of the heading, not so much for actual use, but rather to induce confidence in the minds of the men at work. The drainage heading would be commenced and driven ahead at as high a speed as was found to be practicable, it being a matter for the directors to decide whether this should be completed before proceeding with the main tunnels, or whether they should be carried forward at the same time. It would be necessary to keep an efficient supply of air throughout the entire length of the heading for the men employed. This could be best effected by bratticing off the upper portion of the heading, thus forming a conduit of the required size for the volume of air, which would be blown in by high-speed fans. Such would be the primary ventilation, and permanent ventilation of the main tunnels would be established by blowing air in the direction in which each train was travelling. The traffic being electrically operated, the volume of air required was very largely reduced. To keep the tunnels pure and fresh, it would be necessary to supply 45,000 cubic feet per minute on each line of way, traveling at a velocity of 6 ft. per second, which was equivalent to a very light breeze. The power required to induce this current of air, much assisted as it would be by the trains, would not be large, and the entire problem was simple as compared with that in many collieries through which not only were far greater volumes of air blown in order to deal with great "blowers" of explosive gas, but the length of passages through which the air had to be driven or exhausted was considerably greater, and impended by bends which woud not exist in this case.

The prevention of fire in the trains was also one to which much attention had been devoted. In the case of specially built rolling stock for the London and Paris and other expresses, no inflammable material should be used, and as the motors of the electric locomotive would be "armoured" against fire in case of short circuiting no danger would arise as regards the electrical working even from the employment of ordinary rolling stock. Assuming, however, that in spite of precautions any stoppage should occur in the tunnels, the passengers would readily pass along the tunnels in the rear of the train, where ample space would be available, as a footpath, clear of the electrical conductors. The passengers would thus be free from smoke, in consequence of the direction of the current of air always blowing from the rear of the train towards the front. In consequence of the large diameter of the tunnels, the electric conductors could be so placed as not to obstruct the permanent way or interfere with repairs.

The tunnels would be lighted throughout by electricity. A separate and special circuit would be provided, so that in the event of the main traction current failing, the lights in the tunnels would not be extinguished. Carriage lighting would be independent, each vehicle carrying its own store of light. Sanitary and hygienic regulations similar to those so successfully adopted at the Simplon Tunnel would be enforced during the progress of the works. The French engineers had satisfied themselves as to the best position for the sorting sidings and station at Sangatte, and as to the site for the deposit of their moiety of the excavation from the shafts, heading, and tunnels.

Consulting Engineers

Isham Randolph, Chicago

Among the consulting engineers from the other side of the border who have distinguished themselves in connection with Canadian undertakings, a prominent place must be given to Mr. Isham Randolph, of Chicago. Mr. Randolph has an international reputation, and an extended connection in Canada, but he is best known in the East. It was he who was consulting engineer for the City of Toronto during the track elevation contest, which, after being won by the city, was appealed by the railroads to the Privy Council who sustained the City. He was retained by the City of Toronto on the water supply problem, and has been particularly active in that field.

Mr. Randolph was born at Newmarket, Clark County, Virginia, in 1848. His education, both general and technical, was acquired in the school of experience. He entered the profession of engineering in 1868 as an axeman on the Winchester & Strausburg Railroad, a part of the Baltimore and Ohio system. After the location, he continued on that work as rodman until its completion. In 1870 he was leveller on the surveys for the Washington and Ohio Railroad. In 1871 he was transit man on the survey for the extension of the Lehigh Valley Railroad from Jugtown Mountain to Perth Amboy, N.J.

Mr. Isham Randolph.

In March, 1872, he re-entered the service of the Baltimore and Ohio Railroad as transit man in the extension of that line to Chicago. In this capacity he located the line from Syracuse, Indiana, to Chicago. Later, as resident engineer he built twenty-seven miles of this line and the roundhouse and shops at South Chicago. In 1876 he entered the service of the Sciota Valley Road as assistant engineer, and later became roadmaster of that line. In 1880 he went to Chicago as Chief Engineer of the Chicago and Western Indiana Belt Railway of Chicago. There he had extensive experience in the building of railroad terminals, freight houses, round-houses, etc.

In 1885 he opened an office for general engineering work in Chicago. In 1886 he was employed by the Illinois Central Railroad in the location and building of the Chicago, Madison & Northern Railroad and the Freeport and Dodgeville line as Chief Engineer. In 1888 he resumed the general practice of engineering in the city of Chicago and was employed as engineer on various projects and later as consulting engineer for the Union Stock Yards & Transit Company and the Baltimore & Ohio Railroad Company.

On July 7, 1893, he was elected Chief Engineer of the Sanitary District of Chicago and served in this capacity for fourteen years, during the entire period of construction of the Chicago Sanitary & Ship Canal, a project costing some sixty millions of dollars. He retired as Chief Engineer in 1907, and has since served the Sanitary District as Consulting Engineer.

He was appointed by President Roosevelt on the Board of Consulting Engineers for the Panama Canal, and was one of the five members of the Board whose minority report was accepted by the President and Secretary of War, approved by the Panama Commission and adopted by Congress.

In 1908 President Roosevelt invited him to be one of six engineers whom he wished to have accompany President-Elect Taft to Panama to consider "whether or not there is any reason to change the plans upon which we are working." This Board of Engineers submitted its report to the President on Tuesday, February 16, 1909, unanimously upholding the plans for the lock canal across the Isthmus.

He recently served the City of Milwaukee as Consulting Engineer on its harbor project and prepared comprehensive plans for harbor improvement there.

He was Chairman of the Internal Improvement Commission of Illinois, which Commission was charged with the duty of planning the Deep Waterway from Lockport to Utica, for which the State voted an issue of twenty million dollars in bonds. He is a member of the Illinois State Conservation Commission. He was a member of the Harbor Commission of the City of Chicago, and is consulting engineer for important engineering projects in Toronto, Buffalo, Baltimore, Maryland, and other cities.

He is a past-president of the Western Society of Engineers and a member of the American Society of Engineers; also a member of the American Institute of Consulting Engineers. In 1910, the University of Illinois conferred upon him the degree of Doctor of Engineering. He is a member of the Rivers and Lakes Commission of Illinois.

In February of this year the Franklin Institute of the State of Pennsylvania conferred upon him the Elliott Cresson Medal, the highest award in the gift of the Institute in recognition of "Distinguished Achievement in the Field of Civil Engineering."

Regina Engineering Society

The second annual banquet of the Regina Engineering Society was held at the Metropole Hotel, Regina, on the evening of October 2nd. Mr. H. S. Carpenter, Chairman and President, presided.

Mr. L. A. Thornton, formerly City Engineer and now City Commissioner, proposed the toast paid to the Dominion of Canada, to which response was made by His Honor, Lt.-Governor Brown. "The City of Regina" was proposed by Mr. W. Parsons, who paid a tribute to the enterprise that the city had showed in carrying out her municipal programme in the face of financial stress. Reply was made by His Worship Mayor Martin, while Mr. J. F. Bole, M.L.A., also responded, expressing himself in favor of the formation of a provincial engineering society for Saskatchewan.

The toast to "Kindred Societies" was proposed by Mr. R. N. Blackburn and responded to by Mr. F. C. Clemesha, of the Architects' Association, and Mr. M. B. Weeks of the Surveyors' Association. Mr. Blackburn outlined briefly the history of the three professions, from mediaeval times up to the present. Mr. Clemesha called the attention of the engineers to the fact that the Architects' Association was already provincial in its scope, and said that he hoped the time was not far distant when they would be able to effect a wider organization. Mr. Weeks conveyed greetings from the Surveyors' Asscoiation, which, he also said, was a provincial organization.

The toast to the "Guests of the Evening" was proposed by Mr. O. W. Smith and responded to by Mr. H. G. Smith, President of the Board of Trade, a body which has recognized the importance of engineering and allied societies by the organization of the Engineers and Architects' Committee.

Personal Mention

Mr. W. S. Harvey has been appointed City Engineer of Lethbridge, Alta., vice Mr. A. C. D. Blanchard, resigned.

Mr. W. G. Chace has been appointed Chief Engineer of the whole project in connection with the Greater Winnipeg Water Supply.

Mr. G. F. Porter, Engineer of Construction for the St. Lawrence Bridge Company, Montreal, has been elected to membership of the American Society of Civil Engineers.

Mr. T. W. Roby, designing engineer with Henry Goldmark, consulting engineer of New York City and Kingston, Ont., has been elected an Associate Member of the American Society of Civil Engineers.

Mr. S. E. Rockwell, Resident Engineer for the Puget Sound Bridge & Dredging Company, Victoria, B.C., and Seattle, Wash., has been elected an Associate Member of the American Society of Civil Engineers.

Mr. J. E. Pennybacker, who was recently appointed in an advisory capacity to the Ontario Highway Commission, was in Toronto last week conferring with the provisional authorities in regard to plans for future development.

Mr. C. B. Brown, Jr., Chief Engineer of the Intercolonial Railway, Moncton, N.B., and Mr. W. E. Smith, engineer with the Calgary Asphalt Paving Company, Limited, Calgary, Alta., have been elected full members of the American Society of Civil Engineers.

Mr. G. Janin, chief city engineer of Montreal, has just returned from a visit to Europe. He has gathered a large amount of data bearing on European civic administration, engineering problems, and road work. His report has been submitted to the controllers.

Mr. C. F. Krumbiegel, resident Canadian engineer of the Deutsche Machinenfabrik A. G., Duisburg, Germany, is on a visit to the home office. On his return he will be permanently located in the office of Messrs. Gerald Lomer, Montreal, Canadian representatives of the German company.

Mr. Tanaka Kozo, engineer of the Japanese Railway Board, and Mr. Nakamura Kenichi will undertake investigations of railway management and engineering abroad for the Japanese Government, the former in Belgium and England, and the latter in Canada, the United States, Germany and Switzerland.

Mr. Walter J. Francis, the well known consulting engineer of Montreal, addressed the engineering students of the University of Toronto last week on the occasion of the annual open meeting of the Engineering Society. The subject of Mr. Francis' address was "Engineering as a Profession," from which we hope to give some extracts in a later issue.

Messrs. Douglas-Milligan, Limited, building and mechanical specialists, Montreal, announce the opening of a new Toronto office in the Tyrrell Building, 95-97 King street east, under the management of Mr. W. M. Campbell (mechanical lines), and Mr. C. A. Fox (building lines).

Mainly Constructional

The News in Brief—From Coast to Coast

The contract for the Quebec dry dock has been awarded to Mr. M. P. Davis for $2,721,156.

Building permits in London, Ont., up to the middle of October, 1913, exceed the total for the whole of last year by over $430,000.

It is expected that the new $200,000 court house at Vernon, B.C., will be roofed within the next month or so, steady progress being made with the work.

Contracts will be let some time in November for the new $200,000 commercial high school which is to be erected in Toronto. Excavation will commence this fall.

The Dominion Board of Railway Commissioners have ordered that the clearing of the site for the new Union Station at Toronto be commenced within the next week.

The Burrard Peninsula, B.C., Joint Sewerage Commission have accepted a loan of $500,000 from a firm of London bankers to carry out their necessary sewage disposal works.

The Provincial Board of Health of Ontario have made suggestions to the city of Peterborough which practically means that a new sewage disposal plant will have to be installed there.

Up to date $9,800,000 has been paid by the Government to the Canadian Northern Railway under the fifteen million dollar subsidy agreement of last session, for the company's transcontinental line.

"The Qu'Appelle," at Regina, is also under way, and the entire space to be occupied by this hotel has been excavated and the foundation is now being put in so that the steel work can be commenced this fall.

Efforts are being made to induce the eastern section of the Canadian National Association of Builders' Exchange to hold their convention in Montreal at the end of January, at the time the Montreal Builders' Exchange hold their annual dinner.

The city council of Regina has drafted a programme of paving work to cost $650,782.46, to be done next year. It has also approved of a by-law providing for the issue of $119,427.24 of debentures to be used in concrete sidewalk construction throughout the city.

"The Fort Garry," Winnipeg's new hotel, built by the Grand Trunk, is nearing completion, and it is expected that it will be opened on or about December 1st next. The power plant of the hotel has been started and the work of furnishing is being carried on night and day.

The time for receiving tenders for the second section of the new Welland Ship Canal closed on the 15th inst. The Government intends to lose no time in letting the contract. This will allow of the construction work proceeding simultaneously on sections one, two and three of the canal, one and three being already under contract.

"The Macdonald," at Edmonton, one of the chain of Grand Trunk hotels, is progressing favorably, the steel work on this building being up to the roof, while the stone work is up seven floors, and it is anticipated by the contractors that the building will be roofed in this fall. It is not expected, however, that the hotel will be open until the fall of 1914.

About three hundred men are engaged on the five shops being constructed at Longueuil, P.Q., for the Armstrong Whitworth Company. Various railroad sidings, including that of the Quebec, Montreal and Southern Railway are being brought into the works. There is already sunk a six hundred feet artisian well for drinking water and a chimney of over 150 feet in height is in course of erection.

Railway construction work now going forward in the immediate vicinity of Kamloops, B.C., is estimated as amounting to at least $6,000,000, the present extensions of the Canadian Northern figuring as the most important item in this programme. Recently compiled figures indicate that there are now more miles of railway under construction in British Columbia than the mileage in actual operation.

The Montreal Electrical Service Commission expect to have the wires placed in the underground conduits on St. Catherine Street by May 1st next. The commissioners have therefore suggested that the City Council should pass a bylaw requiring that all buildings erected and to be erected, on this and other streets should be wired to suit the underground distribution. All customers for electric light or power must change their interior wirings to the satisfaction of the Canadian Fire Underwriters' Association.

By June next the Canadian Northern will run through trains between Toronto and Edmonton, and, by August, trains will commence running from Montreal through to the Pacific Coast via Edmonton, over the Canadian Northern Railway. This announcement was made recently by Sir Donald Mann. Sir Donald said the line between Sudbury and Port Arthur would be finished by December, and the two ends of the steel on the main line between Edmonton and the Pacific Coast, would be connected about the middle of next summer.

At the suggestion of the Pedlar People, Limited, the Montreal Builders' Exchange have decided to take up the question of the insolvency law, with a view to securing amendments. A committee consisting of Messrs. Gilday, McKergow, Locker, Potter and Werry have been appointed to study the subject, and join with the other bodies interested in obtaining an improvement in the law. Messrs. Brunet, Pauze, Allan, Stinson and Werry have been appointed on a committee to look into the lien law and report to the exchange with a view to securing amendments to the existing law.

The Canadian Northern have had about 25,000 men engaged upon construction this year, and, according to Sir William Mackenzie, the company have spent four million dollars since the beginning of the 1913 season. By the end of the season the company will have added between one thousand and eleven hundred miles to the trackage in the Dominion. They will have completed by then the laying of track on the line between Port Arthur and Sudbury, which will connect the western and eastern systems and give the country another Transcontinental line between East and West. By the end of the year there will remain but a fifty-mile gap to be finished between Edmonton and the Pacific Coast.

Mr. C. E. Watkins, a well-known Victoria architect, recently completed plans for an apartment block to cost about $45,000. The building is to be of brick veneer and concrete construction, with frame interior and three storeys in height, containing 24 suites of two and three rooms each. Disappearing beds will be used, gas stoves will be placed in each suite, and there will be a well-equipped laundry in the basement for general use. Messrs. Fulton Bros. have been awarded the contract for this building. Mr. Watkins has also completed plans for the new Quadra street school. This building will have brick walls and fireproof staircases, and will contain eight classrooms, and a large assembly hall measuring about 50 feet square.

In order to get into close touch with the highway needs of all sections of older Ontario, the Provincial Highways Commission will this winter hold sessions at various points, at which county and municipal representatives will be asked to attend with a statement of their views. The representatives will be encouraged to state their opinions as to the kind of roads desired in each locality, the sources from which revenue can be derived, the value of statute labor, the classification of roads and the governing body in which control of each class should be placed, and the particular roads that are best adapted for development as main market roads. They will also be asked to state their views as to the width of tires and the control of automobile, traction engine, motor truck and other traffic.

Mr. C. C. Whittier has been made Treasurer and General Manager of Robert W. Hunt & Company, Limited, with headquarters at 905 McGill Building, Montreal. Mr. Whittier has been residing in Winnipeg in charge of the company's business in that district, but has removed to Montreal. Mr. T. C. Irving, Jr., has been re-elected Vice-President of the company and will remain in charge of the business in Toronto and surrounding district. Mr. B. N. Dickman, the well-known mining engineer, has become associated with Robert W. Hunt & Company, in the United States, and with Robert W. Hunt & Company, Limited, in Canada. His headquarters will be 2200 Insurance Exchange, Chicago. He is now engaged upon the examination of gypsum and coal properties in Western Canada.

The plans for the interior storage elevator, which the Dominion Government will erect in Moose Jaw, have now been decided on. The elevator will consist of 84 concrete tanks with 66 inter-space tanks. The space occupied by these tanks will be 44 by 88 feet. The buildings are to be of fireproof construction, concrete and brick with reinforced steel. The plant will include receiving, cleaning and shipping plants with workhouse, track sheds, storage house and drier plant, all to be completed and ready for operation by December 1st, 1914. On each side of the workhouse there will be railway tracks, on the receiving side three tracks, and on the shipping side two tracks. The workhouse will be 76 by 158 feet, and will be 169 feet in height, with 16-foot foundation underground. The equipment will consist of 50 circular bins, 36 interspace bins, and 26 outer space bins, with storage capacity of 500,000 bushels. The storage elevators will contain 150 bins with a capacity of three million bushels.

Electric Welded Chain

The McKinnon Chain Company, of St. Catharines, Ont., have added to their equipment new machinery for the manufacture of heavier sizes of electric welded chain. These sizes are ⅝-in. and ¾-in. chain, which are made on automatic machines and welded by a special process under patents controlled exclusively by this company. Sizes of electric welded chain up to ½-in. inclusive have been furnished during the last five years.

The features of McKinnon electric welded chain are the location of the weld at the side of the link at the point of least wear, and a swell at the weld resulting from the strengthening of the only possible weak point by the addition of 25 per cent. more material. This increase at the weld actually makes the weld the strongest instead of the weakest point of the link, and repeated tests have proved that over 95 per cent. of this chain will pull stiff before it breaks and that the break will occur at some point other than the weld.

McKinnon electric welded chain is all made from the highest grade of steel and every pound is actually proof-tested before leaving the factory. McKinnon electric welded chain is the only welded chain made in Canada. By reason of this, as well as the automatic process of manufacture, the company claim to sell at prices much lower than those that obtain on the imported product.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Calgary, Alta.

Resolution passed by council authorizing Waterworks Dept. to install meters throughout city. Tenders will not likely be called for until first of year. Commissioner, A. G. Graves. Waterworks Engineer, A. W. Ellson Fawkes.

Delhi, Ont.

Waterworks system, cost $32,000, for Town Council. Clerk, Roger Crysler. Specifications not yet prepared.

Edmonton, Alta.

The City Council plan extension of city watermains along 122nd Ave. to 127th St. north to 129th Ave. to railway terminus financed by J. D. McArthur. Clerk, C. E. Cox. Engineer, A. J. Latornell.

Hamilton, Ont.

Storm sewer system, cost $650,000, for City Council. Mayor, Jno. Allan. Engineer, A. F. Macallum. The Works Committee has recommended the Board of Control to submit by-law to ratepayers next January to raise the above amount.

Montreal, Que.

Sewers planned by Board of Commissioners. Sec., L. N. Senecal. Council has voted the following amounts for sewers on Old Orchard Ave., $7,700; Desmarteaux St., $3,300; Toulouse St., $12,000.

Council has voted the sum of $90,000 for the laying of watermains in a number of streets. Board of Commissioners. Sec., L. N. Senecal.

Ottawa, Ont.

Water supply system, cost $8,000.000, for City Council. Mayor, J. A. Ellis. Engineer, Sir Alex. Binnie, London, Eng. Report has been made, gravity supply from Thirty-one Mile Lake with reservoir at Chelsea, 2 suspension bridges will be built, also 1 tunnel. 50 miles of 54 in. steel pipe will be required.

Water meters for City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Sub-committee appointed to look into the advisability of metering all large premises. Committee, Ald. Brethour, Ald. Fisher, and City Engineer.

Preston, Ont.

The Board of Health recommended sewers on the following streets, Montrose, Hedley, Laurel and Lowther, petition for sewer on Church St. was granted. Clerk, H. C. Edgar.

Pavements on Guelph and King Sts. planned by Town Council. Clerk, H. C. Edgar. Engineer, Frank Barber, 57 Adelaide St. E., Toronto. Tenders received by engineer until October 27. Bitulithic, asphaltis concrete and rocmac. Plans are also ready for sewer on Montrose.

Swift Current, Sask.

Sewers and water main planned by Town Council. Sec.-treas., G. D. Arnott. Engineer, Geo. D. Mackie. Tenders are to be called shortly for the excavation and laying of 600 ft. of 18-in. sewer tile 600 ft. of 15-in. sewer tile, 1,000 ft. of 12-in. sewer tile, 1,000 ft. of 8-in. and 10-in. water main.

St. Thomas, Ont.

Sewers, New and Oliver Sts., for City Council. Mayor, E. N. Price. Plans being prepared.

Reinforced concrete pavement, Alma St., planned by City Council, 32 ft. wide, from Talbot to Redan St., and 26 ft. from there to city limits. To be put in shape this fall and paving started in spring. Mayor, E. N. Price.

Toronto, Ont.

Sewers planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Nov. 4th. Plans, etc., at office of Works Dept. Division No. 2, West Toronto, Contract No. 3. Outlet from Keele St. and Uttreley Park to Quebec and Annette via Uttley Park, Hillsview ave., Medland Cres., Humberside avenue and Quebec avenue.

Commissioner of Works, R. C. Harris, City Hall, has recommended brick block pavement, cost $13,892, St. Clair Avenue, from McRoberts Ave. to G. T. R., 18-ft. pavement on each side of track allowed.

Sewers for Board of Control. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris, City Hall. Moore Park Drainage System recommended by Commissioner as local improvement. Western Section, $464,895; Eastern Section, $88,300.

Roadway for Ward Cartage Co., 1154 Dundas St. Tenders received by Owner or Mr. LePage, 102 Tyndall Ave. Concrete roadway, 350 ft. x 16 ft. wide.

Waterworks, pumps, etc., cost $500,000, for Board of Control. Chairman, Mayor H. C. Hocken. Mechanical and Electrical Engineer, Mr. Jas. Milne, Dept. of Works, City Hall. Tenders received until noon Nov. 25th for one or more 7½ and 20 million Imp. gal. pumping engines, 3 water tube boilers with piping. Coal handling apparatus at the High Level Pumping Station. Specifications, etc., at office of Engineer.

Winnipeg, Man.

Water system, cost $13,500.000. Shoal Lake, for Board of Control. Sec. M. Peterson. Engineer, J. G. Glassco, 54 King St. Tenders to be called early in January, 1914, for a dyke and channel for the diversion of the Falcon River into Snowshoe Bay, 85 miles concrete aqueduct, 10 miles pipe line (probably 1916 work), 900 lin. ft. tunnel under Red River, 85 miles of construction railway, telephone lines, clearing and ditching. Full particulars, etc., from Secretary.

Tenders received by Board of Control until Oct. 24th, for 50 4 in. gate valves. Specifications at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Hamilton, Ont.

Pavements, cost $50,033, for City Council. City Engineer, A. F. Macallum. Work being done by City. Asphalt, macadam and wood block pavements, cement curbs and walks.

Montreal, Que.

Sewers, cost $59,930, for Board of Commrs. Sec., L. N. Senecal. General contractor, G. H. Moineau. For construction of sewers on various streets of Monkland Property. On McGregor Street, Edward III. Blvd., Turenne and Louis Veuillot Sts., awarded to Palermo, Gentile & Co., 20 Imperial Ave , $14,907. Sewers on Lacordaire, Lajoie and Montsabre, north wards, to S. Ricci & Co., 1753 Ave. Chateaubriand, $18,968. Sewers on Adam, Ontario, St. Catherine, Lafontaine and Geo. V. Ave., to H. Bertrand, 2727 St. Hubert St., $14,182.50.

Ottawa, Ont.

Pavement, Lakeside Ave., for City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractors, Ottawa Constr. Co., Central Chmbrs., Elgin St.

Otterville, Ont.

Standpipe, cost $10,000, planned by Town Council. General contractor, Orn. Oatman. Reinforced concrete storage standpipe.

Port Hope, Ont.

The Town of Port Hope have awarded the contract for sewers on Smith, Alexander, Choate, Martha, Margaret, Hope and William Streets to W. G. Gibson, of Port Hope. Lump sum $5,202. Other tenders submitted were G. A. Outram, $5,300, and H. B. McConnell, Oshawa, $8,400.

St. John, N.B.

Walks, etc., planned. Commissioner, H. B. Schofield. 200 ft. ferry piling awarded to Jas. S. Gregory, Portland Point, $1,500. Driving piles, east side, Robt. Roberts & Sons, 52 Cunard Street. Driving piles, west side, S. Herbert Mayes, 235 Winslow, W.E.

Toronto, Ont.

Concrete curbs, Avondale, Beaumont, Bellair, Dufferin, Elm, Nanton, Symington and Wolseley. Mayor, H. C. Hocken. Work to be done by Commissioner of Works, R. C. Harris, by day labor.

Concrete sidewalks. Board of Control. Mayor, H. C. Hocken. Balfour ave., Wm. Ransom, Dineen Bldg. Belsize Drive, A. J. Penberthy, 292 Booth Ave. Brownlow Ave., Bracondale, National Contracting Co., 9 Garnock Ave. Wilfred, Glen, Wm. Bushell, 168 Dundas St. Bradd, Clifton, Carey Rd., Ramsay Contracting Co., 39 Indian Rd. Cres. Geary, Cuthbert, Herbert Mitchell, 464 Brock Ave. Osler, Thorne Cres., Duchess St., A. Gardner & Co., Yonge St. Arcade. McFarland, Somerset, Pleasant Avenue, R. J. Moyes, 592 Gerrard St. E. Rosemount, Britnell Contracting Co., Dupont St. Spadina Rd., Queen City Concrete Paving Co., 176 Broadview Avenue. Waverley Rd., Riverdale Concrete Paving Co., 256 Jones Ave.

Sewer, cost $97,380, planned by Board of Control. Mayor, H. C. Hocken. Contract awarded to Moran Construction Co., Ottawa, Ont., withdrawn and awarded to Fussell, McReynolds & Co., Dundas St., Toronto. Midway Sewer System Outlet.

Asphalt pavement, cost $59,558, planned by Board of Control. Mayor, H. C. Hocken. General contractor, Commissioner of Works, R. C. Harris. Beaumont, Bellair, Browning, Carlaw, Cumberland, Dunn, Elliott, Grange, Wolseley. Bitulithic pavement on Mavety St., $2,505. Concrete pavement on Lane N. of First ave., $1,138. Work day labor.

Wingham, Ont.
Water mains, Edward and Victoria Sts. planned by Town Council. Clerk, J. F. Groves. General contractor, Wm. Guest, at 34c per foot.

Winnipeg, Man.
Sewers planned by Board of Control in Martin Ave. from Kelvin to Brazier St., awarded to Dom. Construction Co., 290 Selkirk Ave., $125.90. Sewers on East side Euclid Ave., from Austin to Lusted, awarded to J. Le Cour, 264 Edmonton St., $114. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Railroads, Bridges and Wharves

Bosanquet Twp., Ont.
Repairs to drain for Twp. Council. Tenders received by Engineer, R. Tedbell, Con. 10, Bosanquet Twp., Thedford P. O., until Oct. 25th for repairs to Sullivan Drain.

Fort Fraser, B.C.
Grand Trunk Pacific Railway has approved of proposed site for station at Fort Fraser, mileage 372.8 from Prince Rupert E. in Sec. 26-15-5, Coast District.

Ottawa, Ont.
Temporary bridge, cost $10,000 to $15,000, Bank St., for City Council and County of Carleton. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Tenders to be called shortly.

Province of Ontario
Canadian Northern Ontario Railway has been authorized to construct bridge over White's Creek, mileage 64.9 from Toronto.

Peterboro, Ont.
Dam for Dom. Govt. Dept. of Railways and Canals. Tenders received by Sec., L. K. Jones, Ottawa, until 12 o'clock noon, Oct. 31st., for Nassau Dam, Trent Canal. Plans, etc., at office of Chief Engineer of Dept., Ottawa, and Superintending Engineer, Trent Canal, Peterboro.

Rainy River, Ont.
Pile protection work planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders received until Nov. 17th. Plans at office of Dept., F. Y. Harcourt, Port Arthur, J. G. Sing, Toronto, Postmaster, Fort Francis. 800 lineal feet round pile and sheet pile protection work anchored and braced.

Washago, Ont.
Dams and removal of rocks, Severn River, for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Nov. 10th. Plans, etc., at office of J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, J. H. Armstrong, Dist. Engineer, Midland, Ont., Postmaster, Washago, and at Dept., Ottawa.

CONTRACTS AWARDED

Annapolis Royal, N.S.
Five ice piers, cost $34,700, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Engineers & Contractors, Limited. Managing Director, E. M. Archibald, Middleton. Work to be finished in spring.

Ft. William, Ont.
Addition to car barns, cost $40,000, Walsh, for City Council. Architect, City Engineer. General contractor, P. J. Donahue, Cameron Block, S. May St.

Hamilton, Ont.
Freight shed, cost $5,000, Main and Catharine Sts., for Dom. Power and Transmission Co. Supt., Geo. E. Waller. General contractor, Geo. E. Mills, 614 King St. E. Brick and steel construction, concrete foundation, felt and gravel and galvanized iron roofing.

Ingersoll, Ont.
Freight shed, cost $15,000, for C. P. R. General contractors, John Hayman & Sons, Ltd., St. George Apts., London. One storey, 145 x 55, red brick construction, concrete foundation.

Montreal, Que.
Extension of arch now at Glen Yards to accommodate 4 tracks, cost $50,000, Westmount, for Can. Pacific Railway, Montreal. General contractors, Jno. S. Metcalf Co., 54 St. Francois Xavier St.

North Sydney, N.S.
Store and office, cost $15,000, for McCallum & McMillan. Architect, B. A. Huntsman, Sydney. General contractor and mason, F. C. Redding. Carpenter, M. McMillan. Tenders for plumbing received by owners until Oct. 31st. Two storeys, 60 x 53, concrete foundation, reinforced concrete and brick facing construction, felt and gravel roofing.

Sussex, N.B.
Station for Dom. Govt., Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General contractors, British American Construction Co., Ltd., Prince William St., St. John, N.B.

Station planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Chief Engineer, Mr. MacKenzie, Moncton, N.B. General contractors, British American Constr. Co., Ltd., Prince William St., St. John, N.B. Company's Engineer, Jno. Baughan.

Sydney Mines, N.S.
Coal washing plant, cost $35,000, Nova Scotia Steel & Coal Co., H. O. General manager, T. J. Brown, Sydney Mines, New Glasgow. General manager, H.O., Thos. Cantley, New Glasgow. Purchasing agent, W. G. Stanfield, Trenton, N.S. General contractors, owners will do all work. Concrete foundation, reinforced concrete bins, new machinery required

Victoria Harbor, Ont.
Wharf planned by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractors, McFarlane-Pratt-Hanly, Ltd., 43 Scott St., Toronto.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.
City Hall, cost $150,000, Queen and Dalhousie streets, planned by City Council. Clerk, H. F. Leonard. The buildings and grounds committee asked architect, L. H. Taylor, Hope Chambers, to prepare plans. By-law may be submitted to ratepayers in January.

Sunday school, cost $7,000, St. Paul Ave., planned for Baptist Church. Pastor, Rev. Thos. E. Richards, 110 Chestnut Ave. Architect, L. D. Barber, Temple Bldg. Tenders will not be called before December.

Burnaby, B.C.
School, cost $75,000, Vancouver Heights, for School Board. Sec., A. J. Barham. Eight rooms, fireproof and concrete construction. Will allow for double extension. Plans in progress.

Clinton, Ont.
Skating rink, cost $10,000, for Robert Trench, Teeswater, Ont. Steel and frame construction, electric lighting, concrete floors. Plans in progress.

Duck Lake, Sask.
Town Hall, cost $11,000, planned by Town Council. Mayor, Paul Ashby. Sec.-Treas., J. A. Perrit. By-law to authorize the raising of sufficient funds to complete the Town Hall was passed by burgesses.

Exeter, Ont.
Post office, cost $30,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. White brick and cut stone construction. Plans ready.

Forest, Ont.
Post office, cost $25,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Plans in progress.

Gananoque, Ont.
Interior fittings, post office, King St. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 23rd. Plans and specifications at office of W. N. Rogers, Clerk of Works, Public Bldg., Gananoque, T. A. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at Dept., Ottawa.

Gaspe Basin, Que.
Public building for Dom. Govt. Dept. of Public Works. Tenders close with Sec., R. C. Desrochers, Ottawa, Oct. 27th. Three storeys and tower, 58 ft. 10 in. by 35 ft. 10 in., stone foundation, brick construction.

Halifax, N.S.
Tenders addressed to Alex. Johnston, Deputy Minister of Marine and Fisheries, Ottawa, will be received until Dec. 15th for the construction of a wooden lighthouse and dwelling and boathouse combined, at Beaver Harbor, Halifax County. Plans, specifications, etc., at this Dept., Ottawa and Halifax, and Post Of-

fices, Beaver Harbor, Sherbrooke, Isaac's Harbor and West River Street Harbor.

Lindsay, Ont.
Addition and alterations to post office planned by Dom. Govt., Dept. Marine & Fisheries. Secretary, R. C. Desrochers, Ottawa. Tenders received by secretary until November 5th. Plans, etc., with Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto; Post Office, Lindsay, and at Department, Ottawa.

Montreal, Que.
Fire and police station, cost $85,000, Bois de Boulogne. Board of Commissioners. Secretary, L. N. Senecal. Architect, C. A. Reeves, 58 St. James Street. Tenders received from Picard & Balin, $90,000, A. Pion, $110,000, A. Gratton, $106,879.

Hospital, Inspector and St. Antoine, planned by Montreal Dispensary. Dr. A. Vipond, St. Antoine and Inspector. New building is contemplated as present one is too small.

Club House for Grand Trunk Boating Club, W. Jennings, Verdun. Plans in progress.

Old Peoples' Home, cost $250,000, St. Laurent, contemplated for Grey Nuns, Guy and Dorchester Sts., Montreal. Architect, A. Piche, Victoria Bldg., Victoria Sq., Montreal. Plans to be drawn up this winter and tenders called in spring. Three storeys, 300 x 80, concrete foundation, reinforced concrete construction, Spanish tile roofing.

Church, Decarie Blvd., contemplated for St. Luke's Congregation, care W. R. Cruikshanks, 115 Drummond. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg. Plans will be ready to call for tenders about Nov. 1st.

School, Maisonneuve (4th Ave.), contemplated by Board of School Commrs. Site purchased and plans will be prepared.

Nanaimo, B.C.
Addition to post office, cost $25,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders will be called shortly for addition of two storeys.

Chlorination buildings, cost $7,000, Lemieux Island, planned by City Council. Mayor, J. A. Ellis. City Engineer, Archibald Currie. Asst. Waterworks Engineer, A. N. Beer expects to have plans prepared and tenders called in about two weeks.

Orillia, Ont.
Addition and alterations to public building. Tenders received by Dom. Govt., Dept. of Public Works, R. C. Desrochers, secretary, Ottawa, until Nov. 5. Plans, etc., at office of Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, Postmaster, Orillia, and at Department, Ottawa.

Regina, Sask.
Drill hall planned by Dom. Govt., Department of Public Works. Secretary, R. C. Desrochers, Ottawa. 272 x 150. Tenders will be called shortly.

Stonewall, Man.
Public building planned by Dom. Government, Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa.

Roberval, Que.
Interior fittings, post office, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Time extended for receiving tenders till November 3rd. Plans, etc., at office of A. Parent, Clerk of Works, Public Bldg., Roberval; Chas. Chapais, Dist. Engineer, Post Office Building, Que., and at Dept., Ottawa.

Toronto, Ont.
Addition to church for St. Hilda's Church Congregation, Fairbank. Tenders open for removal of building and alterations. Plans, etc., with Rev. H. R. Young, 100 Oakwood Ave.

Vancouver, B.C.
Public building planned by Dom. Government, Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders will be called shortly.

William Head, B.C.
Detention building planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, Wm. Henderson, Victoria. Tenders received by Secretary until Nov. 17 for first class detention building.

Winnipeg, Man.
Church, cost $75,000, planned for Maryland St. Methodists. Architect, Jn. Semmens, 905 McArthur Bldg. This project will start in Spring, 1914. Two storeys, 80 x 90.

CONTRACTS AWARDED

Bowmanville, Ont.
Alterations to club house, King street, for Goodyear Tire & Rubber Co. General contractors, H. Gay & Son, Oshawa. Heating and plumbing, R. G. Sturgeon & Co., 202 Charlotte St., Peterboro.

Charlottetown, P.E.I.
Alterations to post office planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, W. W. Harper, 239 Fitzroy St., $3,000. Concrete work, Jno. Power, Cumberland St. Concrete floors, elevators, dumb waiters.

Cobalt, Ont.
Church, cost $10,000, for R. C. Congregation (Cure Arsenault). Architect, Eugene Payette, 103 St. Francois Xavier St., Montreal. Owner doing all work by day labor.

Edmonton, Alta.
Church, cost $70,000, 23rd, for Robertson Presbyterian Church. Pastor, D. G. McQueen, 408 4th St. General contractor, R. Grant, 1626 Jasper Ave. W. Mason, Jack Meatin, 20th St. Painting not let. Plumbing and heating, McKnight & Frost, 9th St. Work done by day labor under supervision of General Contractor. One storey, 96 x 135, red brick and stone construction.

Ft. William, Ont.
Addition to orphanage, cost $25,000, Franklyn, for Roman Catholic Denomination. Architect, H. R. Halton, Port Arthur. General contractor, C Mathieu, Ft. William. Mason, Street Bros., Ft. William. Heating and plumbing, Superior Heating & Plumbing Co., Ft. William.

Fredericton, N.B.
Normal School Annex, cost $45,000, planned by Prov. Govt., Dept. of Public Works. Commissioner, Hon. Jno. Morrissey. General contractor, J. Fred Ryan, Regent St. Walls partly up.

Post office for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Falconer & McDonald, 59 Granville St., Halifax, N.S. Steel, Mr. O'Neil, Pictou, N.S.

Glace Bay, N.S.
Hospital, cost $60,000, planned by Gen. Hospital Board. Chairman Building Committee, N. McKenzie. Architect, Geo. Beckwith, Sydney, N.S. General contractors, Chappell Bros. & Co., Sydney. Three storeys. Walls up.

Kentville, N.S.
Skating rink, cost $11,000, for The Kentville Arena Co. Pres., T. P. Calkin. General contractor, Arthur B. Ward. Ice surface, 70 x 170, building, 190 x 90 x 52 ft. high, will contain ball room, dressing rooms, etc. To be completed in November.

St. John, N.B.
Sunday school building, for Germain St. United Baptist Church. Pastor, F. S. Porter, Queen St. General contractor, R. A. Corbett, Douglas Ave. Heating and plumbing, Jas. McPartland, 25 Nelson Street.

Sudbury, Ont.
Rink for Sudbury Curling Club, Ltd. Sec., L. Lambe. Architect, W. W. Workman, 8 Johnson Block. General contractors, LaBerge Lumber Co., Ltd.

Truro, N.S.
Church, cost $60,000, for First Presbyterian and St. Pauls United Congregations. Sec. of Bldg. Com., H. A. Dickie, Royal Bank Bldg. Architects, Curry & Sparling, 105 Bond St., Toronto, Ont. General contractors, Wilson's Ltd., Truro. To be completed by Nov. 1st, 1914. Grey stone and pressed brick construction.

Toronto, Ont.
Church, cost $60,000, Glen Road, for Northern Congregational Church. Pastor, Rev. F. J. Day, 19 Edgar ave. Arch., John Gemmell, 23 Jordan St. Masonry, Elgie & Page, 18 Toronto St. Brick and stone construction, stone foundation.

Market building, cost $18,916, St. Patricks, planned by Board of Control. Mayor, H. C. Hocken. General contractors, Teagle & Son, 55 Boswell avenue. Excavating, E. Corner, 698 Manning ave.

Winnipeg, Man.
Drill hall, cost $519,929, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, owners. General contractors, Carter-Halls-Aldinger, Union Bank Bldg. Excavating started.

Theatre, Market St., for Paterson & Cass, Canada Bldg. Architect, G. W. Northwood, Northern Crown Bank Bldg. General contractors, J. McDermott & Co., Canada Bldg.

Woodstock, N.B.
Library and Agricultural College, cost $70,000, for Estate of L. P. Fisher, (Allison Connell, Woodstock, N.S.) Architect, G. E. Fairweather, 13 Germain St., St. John. General contractor, J. Fred Ryan, Fredericton. Library walls up one storey, plastering and trimming college.

Business Buildings and Industrial Plants

Bridgewater, N.S.
Creamery for LaHave Creamery Co., Ltd. Tenders received by J. W. Hebb,

Hebbs' Cross, until Oct. 25th, for foundation and building separately or together, concrete foundation, wood construction.

Calgary, Alta.
Warehouse, cost $14,500, planned for Gray, Campbell, Ltd. Work to be done by day labor under supervision of J. J. O'Gara.

Chatham, Ont.
Remodelling mill of Canada Flour Mills Co., planned. Architects, Adam & Adam. Frame building to be replaced by steel and brick work.

Ft. William, Ont.
Orpen Conduit Co., 165 King St. W., Toronto, intend erecting a plant here. Additional information shortly.

Hamilton, Ont.
Factory, Park St. S., for J. & H. Davis, 2 Park St. S. Three storeys, 40 x 92. Plans being prepared.

Midland, Ont.
Malleable iron works planned for Edward Jno. Vanderboom. By-law carried by ratepayers granting loan of $60,000 to Owner. Concrete construction and foundation, waterproofing.

Montreal, Que.
Two stores and flats, cost $9,000, Sherbrooke ave., for Alb. Messier, 15 King Edward ave. Architect, Jos. Dubreuil, Sherbrooke ave. Two storeys, 36 x 44, concrete foundation, felt and gravel roofing. Plans ready.

Artificial ice plant contemplated, Westmount (Hillside), for The Centerfreeze Sanitary Ice Co., Ltd., 601 Merchants Bank Bldg., Montreal. Architect to be appointed after December 1st.

Bank, St. Lawrence and Mt. Royal, for Bank of Montreal, 40 St. James St. Architects, Barott, Blackader & Webster, New Birks Bldg. Work will not start till spring. Two storeys, 40 x 70.

Factory, cost $9,000, for Fyon & Fyon, 288 Garnier St. Architects, Benoit & Girard, 215 St. Catherine W. Work will not be started till spring. Two storeys.

Store and flats, cost $7,500, Smith and Gallery, for Jos. Ward, 115 Youville Sq. Architect, Jos. Sawyer, 407 Guy street. Architect will call tenders for General Contractor at once. Three storeys, 42 x 25, stone and concrete foundation, stone and brick construction.

Metals, Ltd. (Mr. Glass), 30 St. James St., contemplate the erection of a factory.

New Westminster, B.C.
Addition to hotel, cost $8,000, planned by an English Estate. Representative, J. Hutchison. Architects, Gardiner & Mercer, O. West Trust Block. Brick construction, Paris specification, roofing, electric lighting, plumbing. To be completed by January 1st, 1914.

St. Marys, Ont.
Addition to factory. Architects and Owners, C. Richardson & Co. (Dairy Machinery Mfrs.). Four storeys, 40 x 70, white brick construction. Plans ready.

Thorold, Ont.
Store, cost $5,000, contemplated for J. A. Sneath, Albert St. Architect to be selected. Two storeys, white brick construction, stone and concrete foundation.

Villeray, Que.
Store and flats, cost $8,000, planned for Mr. Auger, St. Hubert St., Villeray. Architect, Z. Trudel, 238 St. Andre St., Montreal. Plans will be ready to call for tenders in about two weeks. Concrete foundation, comp. paper roofing, brick construction.

Vancouver, B.C.
Addition to warehouse, cost $10,000, 1198 Helmcken St., for Gray Bros., 402 Pender St. Plans ready.

Winnipeg, Man.
Storage warehouse contemplated for Big Four Transfer Co., 341 Bannatyne ave. President, Jas. Lightfoot. Architect not selected. Building will probably go on next year.

CONTRACTS AWARDED

Brandon, Man.
Warehouse, cost $8,925, 1st St. N., for Prov. Govt. Dept. of Public Works. Minister, Hon. Colin Campbell, Winnipeg. Architect, V. W. Horwood, Winnipeg. General contractors, The Willows Co., Ltd., Brandon. One storey, 30 x 62, brick construction, concrete foundation.

Bridgeburg, Ont.
Factory, cost $20,000, Lewis, for Mentholatum Co., Bridgeburg. General contractors, Turner Constr. Co., Buffalo, N. Y. Plumbing and electrical, Flanders Mfg. Co., Bridgeburg. Three storeys, 60 x 70, brick and reinforced concrete construction.

Calgary, Alta.
Remodelling bank, stores and offices, cost $20,000, 8th ave., for Royal Bank of Canada, Montreal, P.Q. Architect, Kenneth Rea, Montreal, P.Q. General contractors, Purvis & Henderson, Vancouver. This work is the remodelling of the old Hudson Bay Stores. Two storeys, 100 x 130.

Warehouse for Alaska Bedding Co. General contractors, Carter-Halls-Aldinger Co., 7th and 1st St. W. Plumbing and heating, Wm. Head Co.

Garage, cost $6,000. General contractors and Owners, Calgary Brewing Co. One storey, 42 x 92, reinforced concrete construction.

Edmonton, Alta.
Stores and apartments, cost $20,000, Stoney Plain Rd. Architect and Owner, G. P. Dobson, 119 Jasper Ave. W. General contractor, N. B. Eby, 304 Nelson Ave. Two storeys, 40 x 80, mill brick construction, concrete foundation.

Offices, cost $7,500, Jasper Ave., for E. L. Ferris, 43-5 Jasper Ave. E. Architect and general contractor, J. R. Ferris, 43-5 Jasper Ave. E. Two storeys, concrete block and brick construction.

Two stores and apartments, cost $5,000, 24th, for C. R. Horne, 886 24th St. Architect and general contractor, Owner. Plumbing and heating, Modern Heating & Plumbing Co., 45 Morris St. Elec., Burnham Frith Elec. Co., Rice St. Two storeys, 32 x 52, brick veneer construction.

Stores, cost $4,000, 4th Ave. N., for Jno. Fering, 463 2nd Ave. S. W. Architect and general contractor, Owner. One storey, 38 x 66, frame construction.

Store and rooms, cost $7,000, Alberta, for Dr. Campbell, 550 14th St. General contractor, E. D. Williams, 1214 26th St. Two storeys, 30 x 60, frame construction, concrete foundation. Excavating done.

Store and residence, cost $5,000, Alberta. Architect and general contractor, W. Clure. 650 Sinclair. Two storeys, 36 x 36, frame and brick veneer construction, concrete foundation. Excavating started.

Ft. William, Ont.
Nail plant, cost $110,000, Montreal St., for Steel Co. of Canada, Montreal, Que. Architects and general contractors, Prack & Perrine, 38 James St. S., Hamilton.

Business block, cost $20,000, Simpson, for T. W. Bowlker, c/o G. R. Duncan. Architect and general contractor, Henry Russell. Two storeys, 50 x 80.

Hamilton, Ont.
Factory, cost $18,000, Bay and Vine streets, for Duncan Lithographing Company, McNab St. S. General contractor, W. H. Yeates, Jr., 18 Leeming St. Two storeys, brick and steel construction, concrete foundation.

Warehouse, cost $40,000, City Dock, for Harbor Commissioners. Chairman, Geo. J. Guy. General contractor, W. H. Yeates, Jr., 18 Leaming St. Steel, Hamilton Bridge Works, Stuart St. Building to be completed March 1st, 1914. Steel construction.

Addition to garage, cost $5,000, Bay St. N. General contractors and Owners, Auto Garage Co., 80 Bay St. N. One storey addition, 90 x 60, brick construction.

Warehouse, cost $8,000, King St. W., for Gore Realty Co., Federal Life Bldg. General contractor, Geo. E. Mills, 614 King St. E. Three storeys, brick construction, stone and concrete foundation.

Alterations and addition to warehouse, cost $6,000, McNab St. N., for Walter Woods & Co., McNab St. N. General contractor, Geo. E. Mills, 614 King St. E. Two storeys addition, brick construction.

Lindsay, Ont.
Addition to machine shop and garage, William St., for R. F. Thomas, Lindsay Machine Works. General contractor and carpenter, Jos. Grozelle. Mason, James Baldwin. Painting, Geo. McFadden. Electrical, Owner. One storey addition, brick construction.

McAdam Jct., N.B.
Machine shop, cost $45,000, for C. P. R. Engineer, Geo. Wetmore, King St., St. John, N.B. General contractor, Henry Post, Woodstock, N.B. Painting day labor.

Montreal, Que.
Store and flats, cost $6,500, 2122 Main, for Gelinas Freres, 1958 Main. Architect and general contractor, J. D. Blais, 50 St. Zotique. General contractor doing work by day labor. Three storeys, 25 x 74, concrete foundation.

Garage, cost $5,000, 709 Sherbrooke N., for Marcil Trust Co., 180 St. James. Architect, Mr. Harris, c/o Owner. General contractor, Wm. Irving, Guy Block. Heating and plumbing, Alex. I. Mearns, 109 Fairmount. Elec., J. C. Duff, 35 Metcalf St. Concrete foundation, solid brick construction.

Garage, cost $8,000, Westmount (Mt. Crescent Heights), for N. P. Bryant, 84 St. Francois Xavier. Architect, R. E. Bostrom, McGill Bldg., McGill St., Montreal. General contractor, C. Blakely, Argyle Ave., Westmount. Two stys., 25 x 40.

Factory, cost $9,000, Canal Bank, for Canada Sugar Refining Co., St. Patrick

St. General contractors, The Jas. Shearer Co., Ltd., 225 St. Patrick St. Roofing, Hickey & Aubut, 93 Dominion. One storey, 56 x 100, brick construction. Foundations in.

Nanaimo, B.C.

Warehouse, Prideaux St., for The Nanaimo Pressed Brick & Terra Cotta Co. General contractors, McRae Bros. 40 x 60.

New Westminster, B.C.

Hotel, cost $20,000, Liverpool Arms, for T. Ovans. Architects, Gardiner & Mercer, O. West Trust Block. Four storeys, Paris specification, brick and concrete construction. Plans ready.

Hotel for Swanson & Hausen, Occidental Hotel, 718 Columbia St. Architects, Gardiner & Mercer, O. West Trust Block. General contractors, Miller & Jewhurst. Plumbing and heating, H. Archibald. Four storeys, reinforced concrete construction, concrete foundation, Barretts Specif. roofing, electric lighting, hot water, heating, plumbing (Durham System).

Ottawa, Ont.

Stores and offices, cost $150,000, Rideau, for Blackburn Bros., Creighton St. Architect, W. E. Noffke, Central Chambers. Carpenter, Smith Bros., 310 Flora. Steel work up, brick facing up to 4th storey.

Regina, Sask.

Printing office, Halifax, for Saskatchewan Courier, 104 Northern Bank Bldg. Manager, F. Brewgmann. General contractors, Parsons Construction & Engineering Co., Ltd., 1712 Scarth Street.

St. Marys, Ont.

Addition to factory for C. Richardson & Co. Architect, C. E. Richardson, Jr., care owner. Mason, John Barry. Carpentry and heating, owner. Four stys., 70 x 40.

St. John, N.B.

Bank building for Bank of British North America. Architect, G. E. Fairweather, 84 Germain. General contractors, B. Mooney & Sons, 112 Queen.

Stratford, Ont.

Addition to factory, cost $25,000, Erie, for Can. General Electric Co., King and Simcoe Sts., Toronto. Local manager, W. Preston. Architect, J. S. Russel, 21 Downie St. General contractor, J. L. Youngs, Stratford. Three storeys, 50 x 161.

Toronto, Ont.

Stable and garage, cost $5,000, Aylmer Ave., for Britnell Contracting Co., Ltd., 209 Davenport Rd. Architect, N. G. Beggs, 12 Cosgrave Bldg. General contractors, Owners. Two storeys, 44 x 80, brick construction and foundation.

Winnipeg, Man.

Hotel, Smith, for Olympia Cafe Co., 277 Portage Ave. Architects, Jas. Chisholm & Sons, Enderton Bldg. General contractors, Carter-Halls-Aldinger, Union Bank Bldg.

Addition to stables, cost $50,000, Burnell St., for Canada Bread Co., Portage and Burnell. Architect, c/o Owners. General contractors, Gray & Davidson, Wall and Portage.

Addition to hotel for Canadian Pacific Rly. Co. General contractors, Westinghouse Church Kerr Co. Terra cotta, Dom. Fireproofing Co., Ltd., 503 Confed. Life Bldg. All other work done by General Contractor.

Stables, cost $45,000, Alexander Ave., for Dominion Express Co. Architects, Woodman & Carey, Lindsay Bldg. General contractors, Carter-Halls-Aldinger, Union Bank Bldg.

Residences

Hamilton, Ont.

Residence, cost $10,000, Mountainview Survey (Mountain Top), for Cooke & Goulding, Federal Life Bldg. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. 2½ storeys, 30 x 38, brick construction. Plans ready.

Montreal, Que.

Residence, cost $5,000, Northcliffe, for J. Choquette, 460 St. Herbert. Two storeys, 24 x 38, concrete foundation, felt and gravel roofing. Permit issued.

Residence, cost $20,000, Outremont (Querbes) for M. Dagenais, 1055 Laurier Ave. W. Architect, L. R. Montbriand, 230 St. Andre. Tenders to be called shortly for sub-contracts. Three stys., 50 x 72, brick construction.

Ten flats, cost $5,500, St. Germain, for E. Ladouceur, 2735 St. Hubert. Three storeys, 50 x 40, concrete foundation, felt and gravel roofing. Permit issued.

Six flats, cost $9,000, St. Jerome, for P. Labelle, 45 Marquette. Two storeys, 40 x 50, concrete foundation, felt and gravel roofing. Plans ready.

Eight flats, cost $7,000, De La Roche, for R. S. Charlebois, 1234 St. Hubert. Three storeys, 50 x 35, concrete foundation. Plans ready.

Six flats, cost $5,000, Paris, for Alf. Libeau, 30 Soulanges. Three storeys, 30 x 45, concrete foundation. Plans ready.

Eight flats, cost $9,000, Chambly, for L. O. Jalbert, 77 Chambly. Three stys., 26 x 26, concrete foundation. Plans ready.

Nine flats, cost $5,000, Aylwin, for J. V. Gagnon, 1851 Notre Dame W. Three storeys, 45 x 45, concrete foundation, felt and gravel roofing. Plans ready.

Montreal West, Que.

Cottage, cost $8,000, for A. Brunet, Montreal. Architects, Benoit & Girard, St. Catherine and Bluery Sts., Montreal. Plans are to be finished this winter and work start in spring. Three storeys, concrete foundation, brick veneer construction.

New Westminster, B.C.

Apartments, cost $80,000, for J. H. Hanky, Vernon, B.C. Plans in progress.

Ottawa, Ont.

Residence, cost $4,800, Hopewell, for W. E. Hawkins, 41 Hopewell. Double brick veneer construction, stone foundation. Plans in progress.

Residence, cost $5,000, 3rd ave., for J. W. Nelson, 130 3rd ave. Brick veneer construction, stone foundation. Plans in progress.

Residence, cost $10,000, Monkland, for E. I. Shuttleworth, 24 Euclid St. Architect, A. L. Weeks, Can. Life Bldg., Sparks St. Solid brick and stucco construction, stone foundation. Plans ready.

Residence, cost $7,000, Goulborne, for Jas. S. Wilson, 256 Kent St. Brick veneer construction, stone foundation. Plans in progress.

Residence, cost $4,800, Turner, for W. O. O'Byrnes, 577 Arlington. Two stys., double brick veneer construction. Plans being prepared.

Ottawa South, Ont.

Residences, cost about $5,000 each, for Oakland Land Co., c/o J. Spratt, Bank St. Several residences to be built. Brick veneer construction, stone foundation. Plans in progress.

Toronto, Ont.

One detached residence, cost $5,000, Melgund Rd., for Geo. E. Dunning, 691 Ontario St. Architects, Chadwick & Beckett, 18 Toronto St. 2½ storeys, 24 x 33, hollow tile and brick construction, brick foundation. Plans drawn.

One pair residences, cost $8,500, Roxborough, for Ellis & Connery, 209 Manning Chambers. Two storeys, 40 x 48, brick construction, brick foundation. Plans drawn.

Six pair residences, cost $24,000, Boston Ave., for J. A. Gallagher, Langley and Broadview. Two storeys, 33 x 42, brick construction. Plans in progress.

One detached residence, cost $5,000, Fernwood, for R. H. King, 1109 College St. Two storeys, 26 x 44, brick construction and foundation. Plans drawn.

CONTRACTS AWARDED

Brandon, Man.

Five cottages, cost $20,000, 1st N., for Prov. Govt. Dept. of Public Works. Minister, Hon. Colin Campbell, Winnipeg. Architect, V. W. Horwood, Winnipeg. General contractors, The Willows Co., Ltd., Brandon. Plumbing and heating, Mitchell and McGregor, Brandon. One storey, 28 x 42, frame construction, concrete foundation.

Calgary, Alta.

Residence, cost $9,000, Mt. Royal. Owner and builder, H. J. Rowan, 825 14th ave. west. Two storeys, 30 x 39, frame construction. Foundations in.

Residence, cost $12,000. General contractor and Owner, R. H. Rowan, 825 14th Ave. W. 2½-storeys, 30 x 39, brick veneer and stucco construction. Garage in rear, 11 x 28.

Apartment house, cost $20,000, for O. G. Anderson, 1215 12th Ave. W. Architect, Burroughs & Richards, 11 Crown Block. General contractor, Supt., A. P. Hindleman. Two storeys, 100 x 40, brick veneer construction.

Residence, cost $6,000, for J. J. O'Gara, MacLean Block. General contractor, W. Cunningham. Two storeys, 26 x 39, frame construction.

Edmonton, Alta.

Residence, cost $5,000, 21st. Architect and Owner, M. McInnes, 528 McKay Ave. General contractor, R. Gilles, 636 21st. 1½ storeys, 30 x 33, frame construction.

Residence, cost $7,000, 26th, for C. R. Horne, 886 24th St. Architect and general contractor, Owner. Plumbing and heating, Modern Heating & Plumbing Co., 45 Morris St. Elec., Burnham Frith Elec. Co., Rice St. Two storeys, 30 x 32, brick and frame construction.

Residences, cost $5,000 each, 26th for C. R. Horne, 886 24th St. Architect and general contractor, Owner. Two stys.,

(Continued on page 74)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Milverton, Ont.," will be received until 4 p.m., on **Monday, November 3, 1913**, for the construction of a Public Building at Milverton, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the office of J. S. Russell, Esq., Architect, Stratford, Ont., at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the Postmaster, Milverton, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45635. 42-43

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Lakefield, Ont.," will be received until 4 p.m. on **Wednesday, November 5, 1913**, for the construction of a Public Building at Lakefield, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Lakefield, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department —49240 43-44

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year 1914 for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,
Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada,
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine. 42-45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Orillia, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Orillia, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C.DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47491. 43-44

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 4th, 1913**, for the construction of the following sewer:—

Division No. 2, West Toronto, Contract No. 3.

Outlet from Keele St. and Uttley Park to Quebec and Annette via Uttley Park, Hillsview Ave., Medland Crescent, Humberside Ave. and Quebec Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender, the names of two sureties (approved by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, October 15, 1913. 43

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received until

Friday Noon, October 31st, 1913.

for the several trades required in the

Enlargement of Ryerson School.

Fresh Air Class Room on Roof of Hester How School.

Heating, Plumbing and Electric Wiring at Parkdale, Shirely and Kimberley Schools.

Plastering at Kimberley School and Black Loam at Sundry Schools.

Specifications may be seen, and all information obtained at the office of the Superintendent of Buildings, City Hall. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 12 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer,
43

Department of Railways and Canals, Canada

Trent Canal

Notice to Contractors

Nassau Dam

Sealed tenders, addressed to the undersigned and marked "Tender for Nassau Dam, Trent Canal," will be received at this office until 12 o'clock noon on **Friday, October 31st, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of Superintending Engineer, Trent Canal, Peterborough, Ont.

An accepted bank cheque for the sum of $10,000.00 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,

Ottawa, 13th October, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—49189. 43-44

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Pile Protection Work, at Rainy River, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913,** for the construction of a Pile Protection Work, at Rainy River, Thunder Bay and Rainy River District, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of F. Y. Harcourt, Esq., District Engineer, Port Arthur, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.; and on application to the Postmaster at Fort Frances, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48052. 43-44

FOR SALE OR RENT

One ten-ton Ruston-Proctor Steam Roller, good as new.

RIGBY & ANDRUS,
43 St. Catharines, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Port Hope, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913,** for the construction of Harbour Improvements at Port Hope, Durham County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Port Hope, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47820. 43-44

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Lindsay, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913,** for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Lindsay, Ont., and at this department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47381. 43-44

To Contractors

Sealed tenders, endorsed "Tender for Plumbing," addressed to the undersigned, will be received at this Department up to noon on **Tuesday, the 28th day of October,** for the heating and poultry building at the Ontario Agricultural College, Guelph. Plans and specifications can be seen at this Department, and at the above Institution. An accepted bank cheque, payable to the Honourable J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender, and the bona fide signatures and addresses of two sureties, or the name of a Guarantee Company approved by this Department, willing to provide bonds for the due fulfilment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By order,
H. F. McNAUGHTEN,
Secretary Public Works Department.
Department of Public Works, Ontario.
Toronto, 17th October, 1913.

Newspapers publishing this advertisement without authority will not be paid for it. 43

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Positions Vacant

WANTED—Capable Machinery Salesman—only experienced applicants considered. Position offers good opportunity for advancement. Advise experience, present occupation and salary expected.

T. FLEMING,
340 Sparks Street,
43 Ottawa, Ont.

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Residences

(Continued from page 71)

24 x 35, brick construction, concrete foundation. Owner is building 2 other residences, value $5,000. Will be finished about Dec. 15th.

Hamilton, Ont.

Apartment house, cost $25,000, Charlton Ave. and Bay St., for L. Donaldson, 229 Bay St. S. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Day work under supervision of Owner. Three storeys. Plans prepared.

25 residences, cost $50,000, Herkimer St. General contractors and Owners, H. Day & Co., 323 Queen St. S. 2½-stys., brick and cement block construction.

Residence, cost $5,000, St. Clair Ave., for G. M. Jones, 129 Victoria Ave. N. General contractor, A. Heatley, 7 East Ave., S. Brick construction, cement block foundation.

Three residences, cost $10,000 each, Inglewood Drive, for S. McPhie and L. Donaldson, 701 Bank of Hamilton Bldg. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Mason, Geo. E. Mills, 614 King St. E. Carpentry, Donaldson & Patterson, 229 Bay St. South. 2½ storeys, pressed brick and cut stone construction, stone foundation.

Montreal, Que.

Two flats, cost $12,000, 189 Vendome. Owners and general contractors, D. H. Scott & Co., 148 Vendome ave. Two storeys, 25 x 52, concrete foundation, brick construction, felt and gravel and corrugated iron roofing. Permit issued.

Flats, cost $10,000, Notre Dame ave., for V. Trudeau, St. Lambert. General contract not awarded. Concrete foundation, frame and brick construction. Excavating started.

Two flats, cost $6,000, Clifton. Owner and general contractor, D. Blay, 162 Geo. E. Cartier Sq. Two storeys, 25 x 36, concrete foundation, felt and gravel roofing.

15 flats, cost $15,000, Richelieu, for J. P. Tremblay, 341 Oxford Ave. Architect, R. Charbonneau, 15 St. James St. General contractor, Owner, will probably call for tenders on some trades. Three storeys, 80 x 68, concrete foundation.

Residences, cost $15,000, Outremont (Durocher), for W. Boileau & Frere, 332 Chambord. Architect, Chas. Bernier, 70 St. James St. Builders, Boileau & Frere. Three storeys, 50 x 75, cement foundation, brick construction.

Flats, cost $6,000, Lachine (La Salle Park), for Mr. Leblanc, St. James and 17th Ave., Lachine. Architects, Benoit & Girard, St. Catherine and Bluery Sts. General contractor, Owner. Day labor. Three storeys, concrete foundation, brick construction.

Four flats, cost $10,000, Bordeaux, for Lapointe & Pilon, 1101 Ontario E. General contractor, Owner. Day labor. Three storeys, 23 x 85, concrete foundation.

Residences, cost $8,000, Melrose Ave., for A. Halcro, 260 St. James St. General contractor, J. H. Lebocuf, Montreal W. Two storeys, 24 x 25.

Residence, cost $42,000, Westmount (Mt. Crescent Heights), for N. P. Bryant, 84 St. Francois Xavier. Architect, R. E. Bostrom, McGill Bldg., McGill St., Montreal. General contractor, C. Blakely, Argyle Ave., Westmount. Three storeys, 30 x 65.

Residence, cost $7,000, Vendome, for J. S. Cameron, 46 St. Luke St. General contractors, Anglins, Ltd., 65 Victoria. General Contractors doing all trades. One storey, 25 x 39, concrete foundation.

Cottage, cost $8,000, Apt. 8 Vendome, for J. W. Brown, 65 Summerhill Ave. Architects and general contractors, Archambault & Conway, 332 Bleury St. Tenders are being called now for painting, heating and plumbing. General Contractor doing all other trades by day labor. Two storeys, 25 x 50, concrete foundation, stone and brick construction.

Ottawa, Ont.

Residence, cost $5,500, Flora, for D. L. Morrison, care General contractor, S. J. Hunt, 170 Arlington. Two and a half storeys, double brick veneer construction, stone foundation.

Residence, cost $5,000, Daly Ave., for Mrs. John Clarey, c/o General Contractor. General contractor, M. J. O'Connor, 495 Somerset. Double brick veneer construction.

Quebec, Que.

Flats, cost $14,000, St. Cyrille, for E. C. Brochu, 166 Lockwell St. General contractor and mason, E. C. Brochu, 166 Lockwell. Foundation only to be built this fall. Three storeys, 69 x 36, concrete foundation, steel beams, frame, red and Scotch brick construction.

Flats, cost $17,000, Richelieu, for Jno. Perkins, 22 St. Louis Rd. Architect, J. A. Pageau, 528 St. Valier. General contractor, O. Legare, 234 Massue. Other trades not yet awarded. 3½-storeys, 175 x 35, concrete foundation, Scotch brick construction.

Regina, Sask.

Residence, cost $5,000, Robinson street. Owner and general contractor, G. Middleton, 2169 McIntyre St. Brick and frame construction, brick foundation.

Toronto, Ont.

Residence, cost $16,000, Warren Rd., for J. E. Atkinson, Toronto Daily Star. Architects, Langley & Howland, 157 Bay St. Mason, Albert Webb, 13 Shirley Ave. 2½ storeys, 46 x 80, brick and stone construction, slate roofing. Walls started.

Two pair residences, cost $9,000, Earl Gray Road. General contractor and Owner, Dr. J. A. Gallagher, Langley and Broadview. 2½-storeys, 36 x 42, brick construction and foundation.

One detached residence, cost $6,000, Russell Hill Road, for R. G. Brown, 41 Admiral Road. Mason, Bert E. Brobyn, 153 Campbell Ave. Carpenter, Booth & Co., 249 Davenport Road. 2½-storeys, 24 x 34, brick construction and foundation.

One detached residence, cost $7,000, Foxbar Rd., for Mrs. Geo. Acheson, 77 Essex Ave. General contractor, Chas. Parker, 17 Boswell Ave. 2½-storeys, 24 x 33, brick construction, stone foundation.

Winnipeg, Man.

Apartment block, Wellington avenue, for E. Kline, Suite 3, Victoria Court, William ave. Architect, Edgar Prain, Fort St. General contractors, Daykin Scott Construction Co., 127 Higgins ave. Steel, Manitoba Bridge & Iron Works, Winnipeg. Heating and plumbing, Townsend & Gavin, Portage ave. Roofing, plastering, painting and electric, tenders to be called in November.

Welland, Ont.

Residence, cost $6,000, Merritt, for F. G. Gourlay. Architect, T. L. Nicholls. General contractor, J. E. Cutler. Three storeys, 28 x 34, roughcast construction.

Windsor, Ont.

Residence, cost $10,000, Ouellette, for A. A. Little. Architects, Leybourne & Whitney. Owner will do work. Two storeys, 52 x 32, brick and stucco construction.

Power Plants, Electricity and Telephones

Dundas, Ont.

Electric lighting, for Town Council (Water, Light and Power Commission). Clerk, J. S. Fry. Chairman of Commsn., Mayor, R. W. Karch. Estimates have been submitted to Council. Tenders will not be asked but supplies purchased through Ontario Hydro-electric Commission.

East London, Ont.

Sub-station No. 4, cost $20,000, for Hydro Commission. Chairman, Philip Pocock. Architect, H. J. Glaubitz. Motors, transmitters, etc., required. Two storeys, red pressed brick construction, concrete foundation. Plans in progress.

Mount Hamilton, Ont.

The Dominion Power & Transmission Co., Hamilton. Company propose to construct new 35 or 40 pole line extension for electric light service, etc., on or near Concession St. if permit is granted by County Officials. Further information from E. Coleman, c/o Company, Terminal Station, Hamilton.

Smithville, One.

H. Gracey, furniture dealer, wishes information re cost of plant to generate current for about 1,000 c.p. electric light. Gasoline engine prefererd as form of power, also storage attachment sufficient to provide current for 1 to 2 hours after engine is shut down.

Swift Current, Sask.

Gas wells planned by Town Council. Sec.-treas., G. D. Arnott. Engineer, G. D. Mackie. General contractors, North West Drilling Co., Ltd., Calgary, Alta. $11 per foot for a minimum of 2,000 feet. Contractor must bore 1,500 feet at least. Work to start at once.

Power house, cost $9,310. General contractors, Gillstrom Contracting Co. Work to start at once. Sec.-treas., G. D. Arnott. Eelectrical superintendent, A. V. Ross. Engineer, Geo. D. Mackie.

Winnipeg, Man.

Switching gear required by Board of Control. Engineer, J. G. Glassco, 54 King St. Switch for gear and accessories for generating station at Point du Bois. Tenders received by Board till November 4th.

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

The John Inglis Company
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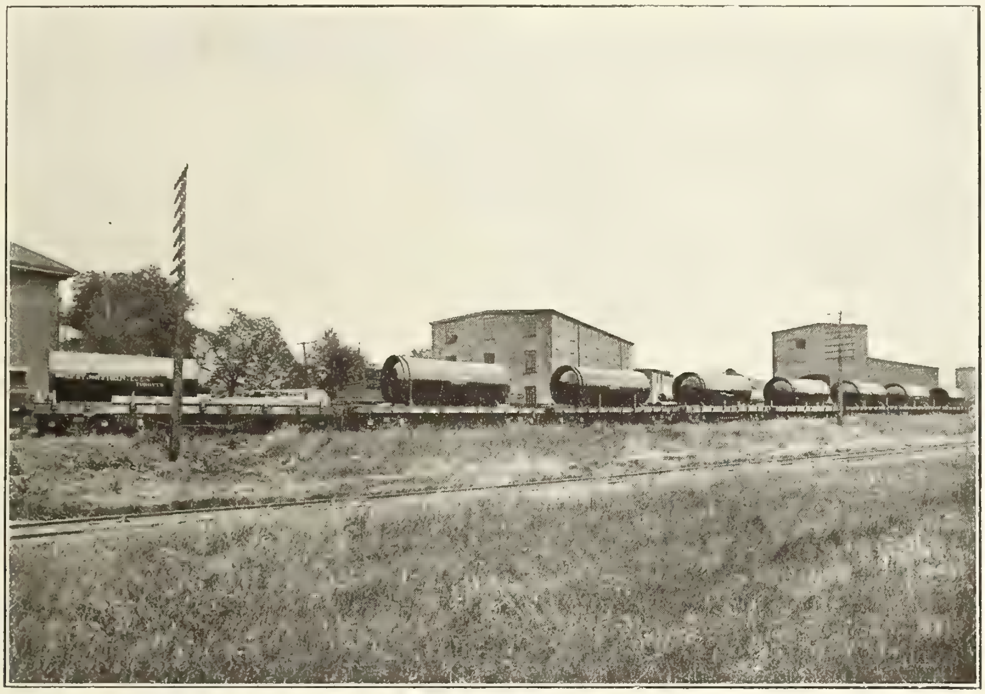
Engineers and Boilermakers



Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

Hoisting Machinery and Equipment of all kinds

Steam Hoists
Electric Hoists
Belt Driven Hoists
Horse Power Hoists

Hand Power Hoists and Derrick Irons to suit any requirements.

10 H. P. Reversible Builders' Hoist, supplied in seven sizes up to 50 H. P. Reversing or non-reversing.

Steel Cars, Skips, Buckets, etc. to order.
Steel work of all kinds a specialty.

Marsh & Henthorn, Limited
BELLEVILLE, ONT.
Makers Hoisting Machinery
Sales Agents: MUSSENS, LTD., MONTREAL

Office of Dominion Iron & Steel Co., Ltd.
Built of Sydney Pressed Brick

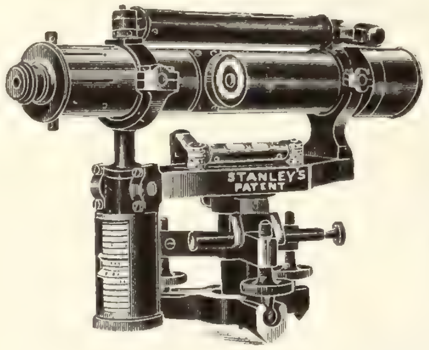
IN this product you get a brick of such superior quality that a saving of one dollar a thousand can be effected in the laying of the bricks as compared with ordinary irregular brick.

The mortar adheres with great strength to "Sydney" pressed brick and they harden with age.

Prices and Particulars on request.

Sydney Pressed Brick Co.
Limited
Sydney, Nova Scotia

TRADE **STANLEY** MARK



Stanley's Gradiometer saves much time in Railway and Drainage Works. Can be divided to read either ordinary or percentage gradients. Illustrated phamphlet on application.

The Largest Manufacturers of Surveying and Drawing Instruments in the World.

Drawing Office Stationery of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our catalogue "K 91" and compare our prices with those of other *first-class* makers.

We were awarded four Grand Prix and a Gold Medal at the Turin Exhibition, 1911.

W. F. Stanley & Co., Limited
Great Turnstile, Holborn, LONDON, ENGLAND

PURE WATER

It is easy to obtain with our plants and apparatus

We design and contract for complete municipal filtration plants of any capacity.

We supply and install apparatus for sterilizing water supplies by the application of calcium hypochlorite.

Literature, Sketches, Estimates and Recommendations Supplied on Request

American Water Softener Co.
1001 Chestnut St., PHILADELPHIA, Pa.

We have no affiliations or working acquirements with any of our competitors.

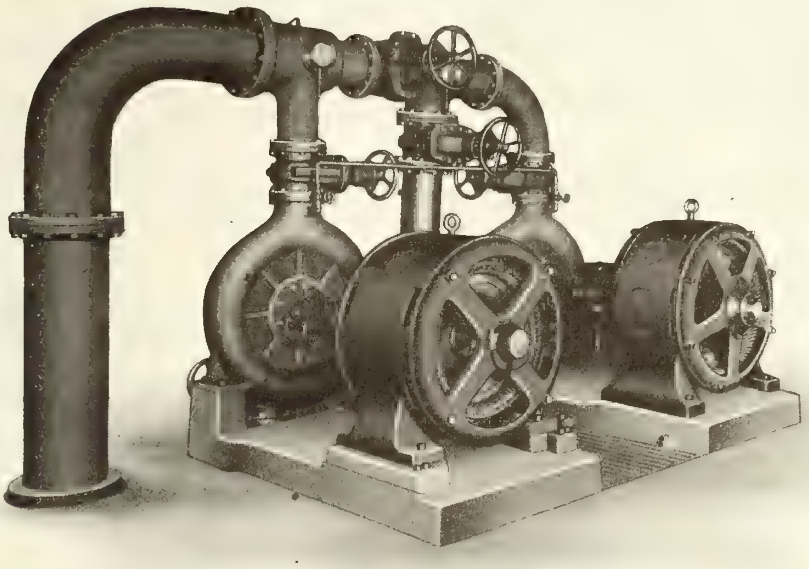
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Every Engineer

Electrical News
Generation Transmission and Application of Electricity

should read the Electrical News. Twice a month it tells of the latest development in connection with electrical power plants and new apparatus. It contains illustrated descriptions of big installations in every part of Canada. It tells of ways and means to improve your plant and to effect savings in operating costs. In short, it is full of information which is helpful to every engineer operating a plant in which electricity is used.

Sample copy for the asking.

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220 King Street West
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BRIDGEBURG ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Buildings and Structural Material.

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SHOPS—**BRIDGEBURG, ONT., CAN.**
Chicago, Ill., U.S.A.
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Grand Trunk Pacific Ry.
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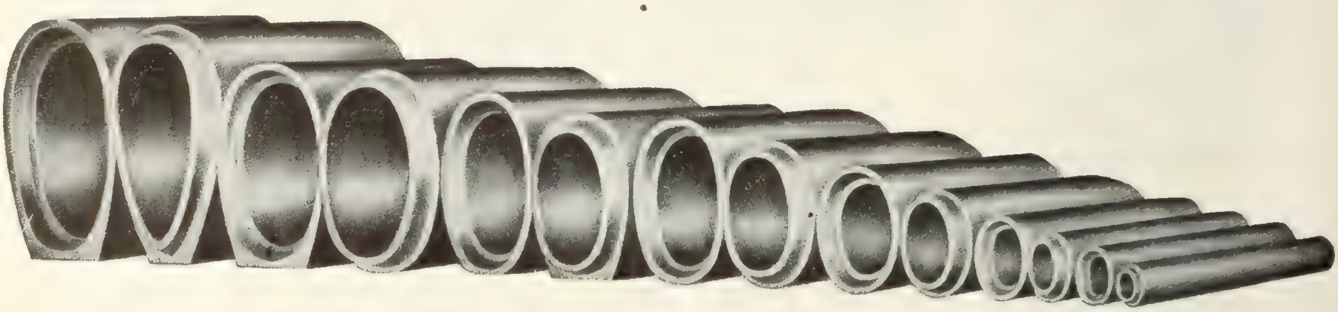


Sewers and Culverts

properly built of properly made

- Reinforced Concrete Pipe -

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

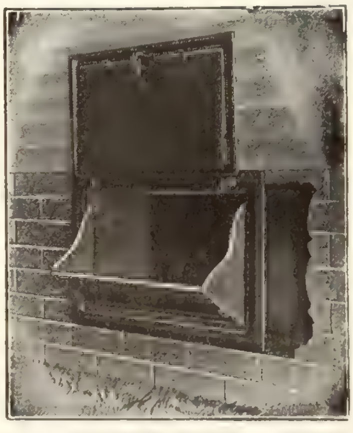
STANDARD REINFORCEMENT, or SPECIAL if required. **Stock sizes 6 in. to 60 in.**

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application.

Dominion Concrete Company Ltd.

Kemptville, Ontario



EQUIP YOUR CELLAR

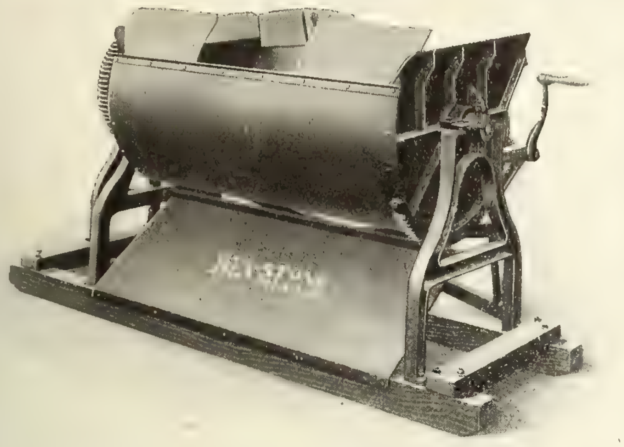
with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar.. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

Toronto Representatives: Black Building Supply Co., Mail Building
Montreal Representative: E. F. Dartnell, No. 8 Beaver Hall Square
Gorman, Clancey & Grindley, Agents, Calgary and Edmonton, Alberta

Time Saved in Concrete Mixing



The Blystone Skid Mixer

Every movement of this mixer is calculated to save time. The mixing is quick and thorough and the dumping, worked by the handle on the right will save moments at every batch turned out. Strongly built—all working parts carefully balanced.

The Blystone Machinery Company
63 Railroad St., CAMBRIDGE SPRINGS, Pa., U.S.A.
Full line of Blystone Mixers carried in stock by
The A. R. Williams Machinery Co., Limited, Toronto, Ont.
N. J. Dinnen & Co., Limited, Winnipeg, Man.
Gorman, Clancy & Grindley, Calgary, Alberta.
Ritchie Contracting & Supply Co., Vancouver, B.C.

"Metallic"

Skylights

You can get any shape or size of skylight made on our modern machines, which produce the desirable hollow metal construction to take plain or wired glass.

We have the best skylight machinery equipment in Canada, and will be glad to learn your ordinary or special requirements for skylights in metal. Write your requirements to us.

Get Catalogue "Z" on "Metallic" Skylights, Ventilators and Cornices. Sent free.

THE METALLIC ROOFING CO.
OF CANADA LIMITED.
TORONTO AND WINNIPEG

Contractors' Acetylene Flare Lights

Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

SIZE NO. 2—

1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

Price F.O.B. Ottawa $65.00.

Manufactured by

International Marine Signal Co. Limited
Ottawa, Canada

Used Machinery and Contractors Plant

FOR SALE

1—40 H.P. Stationary Boiler and Engine
1—80 H.P. Tubular Boiler
2—60 H.P. Tubular Boilers
1—50 H.P. Tubular Boiler
1—2 Yard Ore Car
1—1/2 Yard Milwaukee Concrete Mixer (New)
1—30 H.P. D.D. Electric Hoist
1—No. 4 Champion Stone Crusher
1—No. 5 Pulsometer Pump (New)
2—6x5 3/4x6 Duplex Pumps
1—Stone Elevator for No. 5 Austin Crusher
1—20 H.P. Upright Boiler
3—2 H.P. Electric Motors, A.C.
1—14 H.P. White Traction Engine
1—25 H.P. Portable Boiler and Engine

The above machines are but slightly used and are in good working order.

Fleming Machinery Company
340 Sparks Street, Ottawa, Can.

Dietrich LIMITED

Plumbing and Heating Systems

for all types of large buildings such as factories, office buildings and warehouses.

In this connection we are prepared to undertake the design and installation of such systems, putting emphasis on the fact that by "design" we mean the correct determination of the most efficient system for the particular use under consideration.

300 Read Bldg.
Montreal

Read those underlined words over again,—they are full of importance.

Dietrich LIMITED

Dietrich LIMITED

The ATHEY Cloth-lined Metal Weather Strip

THE only one that keeps out all draughts and dirt.

THE only one with a cloth-lined channel in the sash.

Installed by

The EBERHARD & WOOD Mfg. Co.
Ornamental and General Iron Works
36-38 Lombard St. Phone Main 6338 TORONTO

N.B. Can be installed on Steel Casements of any type.

JAS. DICKSON, Pres. GEO. T. DICKSON, Vice-Pres

Dickson Bridge Works Co.
Limited
Campbellford, Ont.

Bridge over Spanish River at Massey, Ont.

Steel Bridges, Steel Buildings Roof Trusses

and other Structural Steel

Foundry and Machine Shop in connection.
Estimates on application

Use Buffalo Pitts Co.

BUFFALO PITTS COMPANY BUFFALO N.Y. U.S.A.

Traction Trains
and
Haulage Outfits

Send for Art Catalog.

Buffalo Pitts Co., - Buffalo, N.Y.

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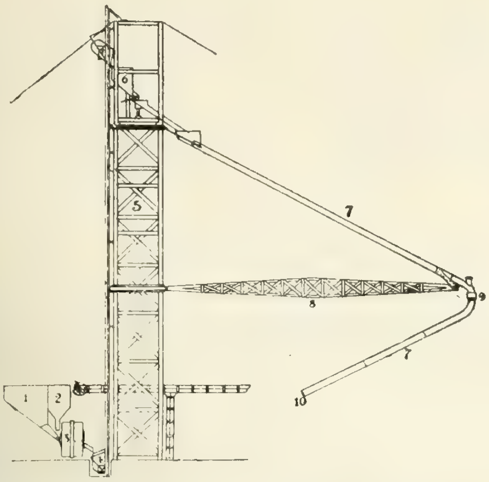
A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



Gravity System
Distributing Concrete

A system that improves the concrete and reduces the cost.

Information gladly furnished and Estimates given on any work.

Canadian Concrete Appliance Co.
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Sole Licensees for Canada
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Eastern Representatives—
STINSON REEB BUILDERS' SUPPLY CO., LTD., MONTREAL, P.Q.

Goold, Shapley & Muir Co.
Limited
Brantford Winnipeg Regina Calgary

Towers and Tanks for all purposes.

Concrete Mixers

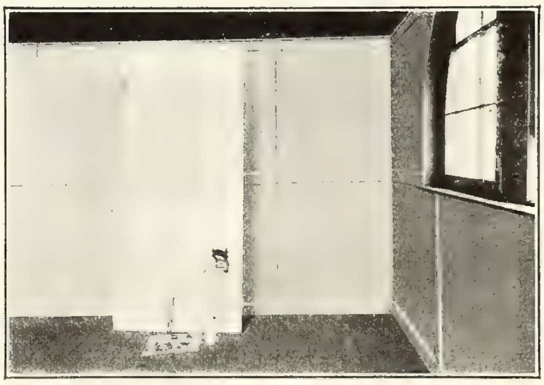
Gas and Gasoline Engines

Hoists

Windmills

Water supply outfits of every description.

CORRESPONDENCE SOLICITED



The Permanent, Protective Building Board

LINABESTOS

Linabestos is a damp-proof, fireproof Building Board made of Asbestos and Portland Cement. It is smooth on one side and somewhat rough on the other, and is made in sheets 42″ wide, 48″ or 96″ long and 3/16 inches thick.

Though hard and semi-rigid, Linabestos can readily be worked with carpenters' tools, and nailed direct to the studding. It is either applied smooth side out and panelled with strips of wood or of the same material, or put on rough side out and covered with a thin skim coat of plaster.

Walls and ceiling of Linabestos will confine an ordinary fire to the room where it starts, and check the spread of even the worst blaze. They are sanitary, easily decorated, non-conductors of heat, practically everlasting and inexpensive.

Write for folder No. 9 giving full particulars.

Asbestos Manufacturing Company, Limited

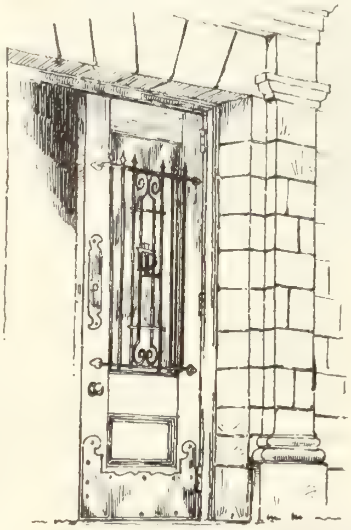
Address; E. T. Bank Bldg. 263 St. James St., Montreal Factory at Lachine, P. Q. (near Montreal)

STANDARD FIRE-PROOF DOORS

INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

ALL OUR DOORS AND HARDWARE ARE LABELLED BY THE UNDERWRITERS.

FEATHER & ROADHOUSE SHEET METAL WORKERS
Phone Adelaide 2377 528 FRONT STREET WEST, TORONTO



Wrought Iron Door Grills

**Kick Plates
Push Plates**

We make all sorts of work in wrought iron, brass and bronze, for the protection and decoration of the exterior and interior of buildings.

CATALOGUE ON REQUEST

Dennis Wire & Iron Works Co.
London, Ont. Limited

Toronto Branch : 36 LOMBARD STREET

Dominion Marble Company
Limited
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SOLE producers of the Beautiful Royal Dominion marble quarried at South Stukely, Que. A card or 'phone call will bring our representative to submit figures on any class of marble work. Address all letters to the Company P.O. Box 1166, Montreal.

NOW is the time to renew your

SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
Hamilton

Pioneer Manufacturer of

Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.
The benefit of 20 years experience as successful contractors.

Yours for the Asking

Hotchkiss Lock Metal Form Co.
BINGHAMPTON, N.Y.

York Sandstone Brick Co., Limited

TORONTO

Manufacturers of

Sand and Lime Brick

BUILDERS—note these points :

OUR PLANT has a capacity of 40,000 bricks per day.
It has excellent delivery facilities.
It is the most modern plant in the city.

OUR BRICK are carefully made under expert supervision. They are fireproof.
They absorb from 10% to 12% less moisture than ordinary clay brick.
Their crushing strength, 3030 lbs. per sq.in. by actual School of Science test, is far greater than ordinary stock brick.
They are the same size as standard stock brick.
They do not break so easily as clay brick and the percentage of bats and culls is very low
They are uniform in color, size and quality.
The older they are, the harder they get.
They give the most value for the least money.

LOOK FOR THE STOCK MARK

Telephone or write for samples and quotations.

OFFICE: 123 Bay St., (Stair Bldg.) Phone Adelaide 2023

WORKS: Cor. Gerrard St. and Victoria Park Ave., East Toronto Phone Beach 1505

Anchor Hard Wall Plaster

HERE is a brand of hard wall plaster that is always ready for immediate use.

It saves from four to eight weeks' time in completing your building because it sets quickly.

Costs less than lime.

Anchor Plaster sets hard as rock and will never come down. Use it for your next job.

Alabastine Hardmortar, Ltd.

123 Bay Street, - TORONTO

Telephone M 6088

Screened Sand and Gravel

Prompt Shipment

York Sand and Gravel Co. Limited

Tel. Beach 233 East Toronto

SEE

Smyth & Ryan

FOR QUOTATIONS ON

Lime, Stone, Cement, Sewer Pipe, Fire Brick, Weeping Tile, Mortar Colors, Plaster, &c.

Toronto Agents for

OWEN SOUND CRUSHED STONE

Deliveries—G.T.R. and C.P.R.

HEAD OFFICE, **1327 Bloor St. West**

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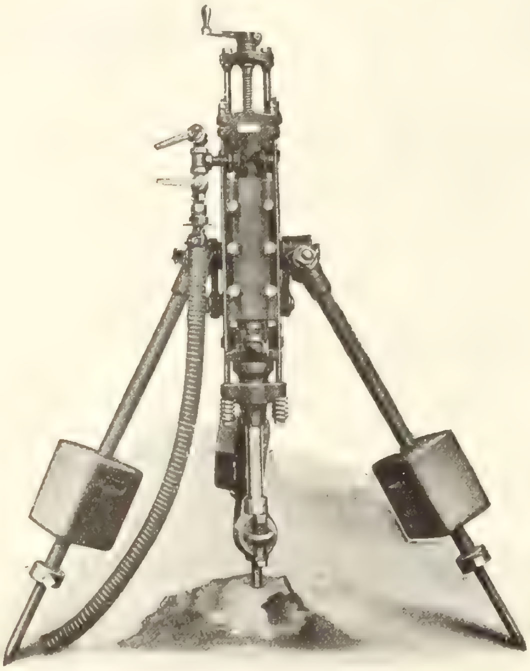
Branch Yards, 53 Merton St.

Phone, North 4751 G.T.R Belt Line

Night and Sunday calls, Phone Junction, 3333.

McKiernan-Terry

CORLISS VALVE ROCK DRILLS



Corliss Valve Rock Drill

The Type "T.C." is a Corliss Valve machine and differs from all other rock drills in which the valve is moved by mechanical or tappet action. It is actuated by two tappets which move freely within a tappet block seated in the cylinder beneath the centre of the valve chest. The tappets, by contact with the inclined surfaces of the piston, move up and down and so impart a rotary or turning motion to the valve, by which means it is operated. So well is it balanced, that the slightest amount of power is required to move it.

The Corliss Valve Drill is economical in power, strikes a quick and powerful blow and has a pullback of remarkable strength. It is as well adopted for use with air as it is with steam.

This is a view of a 3¼ inch Corliss Drill engaged in channelling

When required to work with low steam pressure or "wet" steam, it shows greater superiority over all other drills and under such conditions, it operates with a degree of flexibility only expected of an air machine. The great power exerted on the return stroke adapts it for drilling in soft rock which forms a heavy sludge and does not "mud" freely, as well as for use in hard fitchering ground which tends to stick and bind the steel in the drill hole.

CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturers of :—Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Shovels, Steam Specialties, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Wheels.

Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert
Works: Toronto, Bridgeburg, Stratford, Montreal

Conveyor and Power Belting

Made By the Oldest, Largest and Most Perfectly Equipped Plant in Canada

Is Ready to Give You 100 % In Service and Efficiency

Listen to the clang and whir of one hundred ponderous machines in our belting plant—each doing its allotted part with infallible accuracy.

Watch the elaborate testing precautions—the scrupulous attention to detail—the expertness of the operators and wide-awake alertness of the superintendents—from the time the fabric is first run through the vulcanizing machines until it emerges as a finished belt.

Note how little chance there is for human carelessness or inefficiency to mar the perfect work.

That's scientific belt making—factory pride in its products—reputation jealously guarded.

Our Method of Making Beltings That Endure

This is the way your belting will be made and your belting costs safeguarded—Whether your purchases be great or small.

And forty years of belt making experience will be concentrated on your requirements—putting all the service that it is humanly possible to embody in CONVEYOR or POWER BELTING, to give you perfect satisfaction.

No matter what conditions are we can make belting that will stand the strain. Our knowledge of climatic and working conditions insures this, while our methods of construction leave no possible room for doubting our ability to give you more in belting service than you have ever obtained before.

If the Belting You Buy Has Not Been Giving Service—
LET US DEMONSTRATE WHAT OUR BELTING WILL DO

Our nearest Branch will gladly give you any information you require.

Canadian Consolidated Rubber Co., Limited

Montreal

SALES BRANCHES:

Halifax, ST. JOHN, Quebec, MONTREAL, Ottawa, TORONTO, Hamilton, London, Berlin, Brantford, North Bay,
WINNIPEG, Regina, Saskatoon, Edmonton, Calgary, VANCOUVER, Victoria

NATIONAL PIPE & FOUNDRY CO., LIMITED

WATER WORKS CONTRACTORS

MANUFACTURERS OF

WOODEN WATER PIPE

For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

WRITE FOR INFORMATION

802 McGILL BUILDING, MONTREAL Works: ALEXANDRIA, ONT.

The Maritime Bridge Company, Limited

Successors to

Wm. P. McNeil & Company, Limited

Manufacturers of

Bridges—Steel Buildings
Roof Trusses Turntables
Towers—Girders and
Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, New Glasgow, N. S.

MR. CONTRACTOR!

Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

SAND & SUPPLIES, LIMITED

Phones: Adelaide 1947-1948
SPADINA AVE. DOCK, - TORONTO
AYR, - ONTARIO

JAMES THOMSON, President. J. G. ALLAN Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.

LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

The Canada Iron Corporation, Limited

Head Office:
Mark Fisher Building
MONTREAL

Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

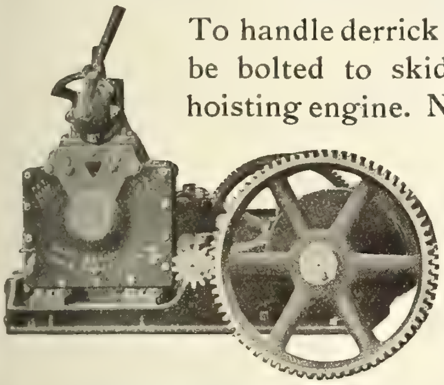
The Dake Swinging Gear

To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

Start, Stop, Reverse at Will

WRITE FOR CATALOGUE CR.

Dake Engine Co.
Grand Haven, Mich.



When you want stone that appeals specify

"Queenston Blue" Limestone

Send us your specifications for Cut Stone work

The Queenston Quarry Co., Ltd.
ST. DAVIDS, ONT.

ROCALITE

The Ready Mixed
Hard Wall Plaster

Manufactured by

Alex. Bremner
Limited
100 Bleury Street - - MONTREAL

"Galvaduct" and "Loricated"

Conduits

for Interior Construction

Conduits Company, Limited
Sole Manufacturers under Canadian and U. S. Letters Patent
Toronto - Canada

CAWTHRA MULOCK, President - - GORDON F. PERRY, General Manager

NATIONAL IRON WORKS, Limited

LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments Offices, Works and Docks, TORONTO

DECARIE INCINERATORS

THE ONLY SYSTEM THAT HAS STOOD THE TEST OF YEARS IN THE SANITARY AND ECONOMICAL DISPOSAL OF REFUSE

DECARIE INCINERATOR CO
MINNEAPOLIS MINNESOTA

S. M. Underhill's Bungalow, Stained with Cabot's Creosote Stains and lined with Cabot's Quilt. Designed and built by Tracy L. Freeman, Nyack, N. Y.

"Cabot's Stains are the only Stains I use when I get up the specifications, and if I build where other's specifications call for other stains I try and get them over to Cabot's, for I know the results are better for all concerned." TRACY L. FREEMAN.

THE ONLY REAL STAINS

If you have only seen the crude and tawdry colors of the thinned paint imitations of

CABOT'S SHINGLE STAINS

you have no idea of the beautiful coloring effects of the true Stains. They are soft and deep, like velvet, but transparent, bringing out the beauty of the wood grain. Half as expensive as paint, twice as handsome, and the only Stains made of Creosote, "the best wood preservative known."

CABOT'S "QUILT" Cold-Proof, Heat-Proof, Sound Proof, 40 Times Warmer than Common Papers.

Send for samples and full information.

SAMUEL CABOT, Inc., Sole Manufacturers BOSTON, MASS., U. S. A.

Canadian Agents:
A. Muirhead Co., Toronto.
Henry Darling, Vancouver.
Saskatchewan Supply Co., Saskatoon.
Braid & McCurdy, Winnipeg..
Seymour & Co., Montreal.
Can. Equipment & Supply Co., Calgary and Edmonton.
F. A. Gillis & Company' Halifax and Sydney.

"A MOST INGENIOUS AND USEFUL DEVICE"
—Furnishing World

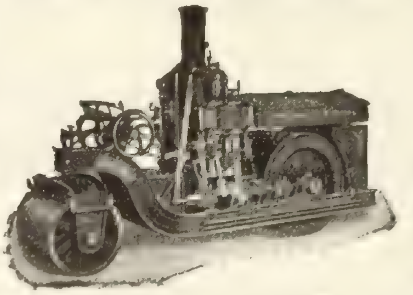
Invaluable to—
Piano Manufacturers
Furniture Manufacturers
Case Goods Manufacturers
Architects and Builders

Neat and Strong
Write for Booklet

SOSS INVISIBLE HINGE CO., LTD
104 Bathurst St., TORONTO

ERIE MACHINE SHOPS

P. W. DIETLY
Proprietor



"Our 20th Century Roller"

Send for our Catalogue of Asphalt Rollers and Mixers.

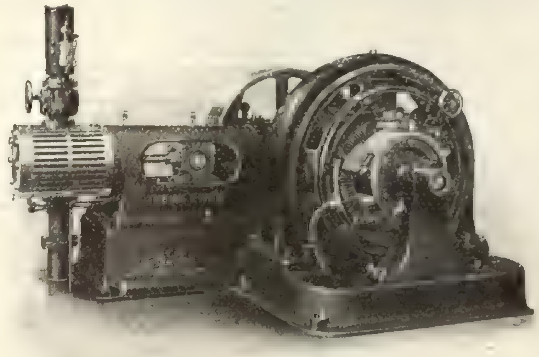
1303 PEACH STREET - ERIE, PA.

McEWEN ENGINES

are sold on a basis of quality — of economical and efficient **initial** performance that is maintained year after year.

Every dollar put into the cost of your McEwen you get out in continuous satisfactory reliable service. They improve with use.

All sizes—simple and compound—up to 700 H.P. The McEwen booklet will interest you.



The Waterous Engine Works Co.
Limited
Brantford, Canada

Vault Doors and Safes

J. & J. Taylor
Toronto Safe Works
Established 1855 TORONTO
Branches Vancouver and Winnipeg
Montreal

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock	net$1.85
No. 4½ Fuller's	net$2.50

Square head brass cocks, 65 per cent,

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

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Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

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6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

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Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

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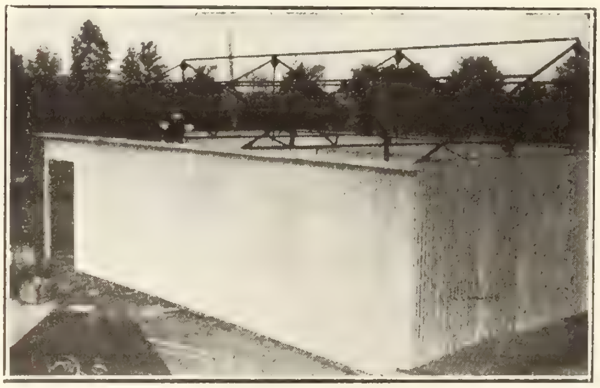

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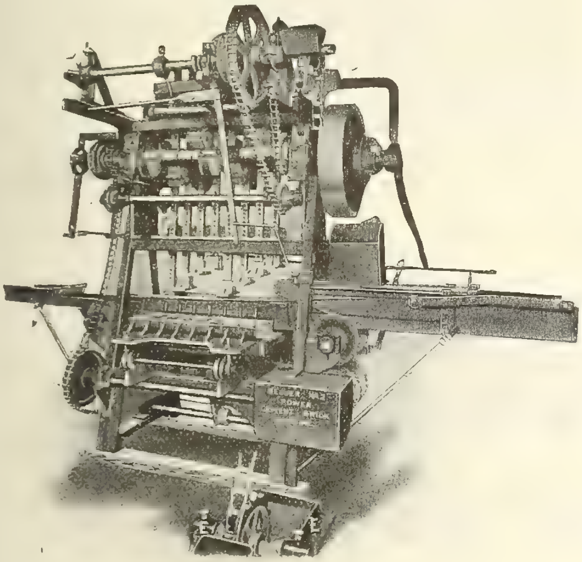

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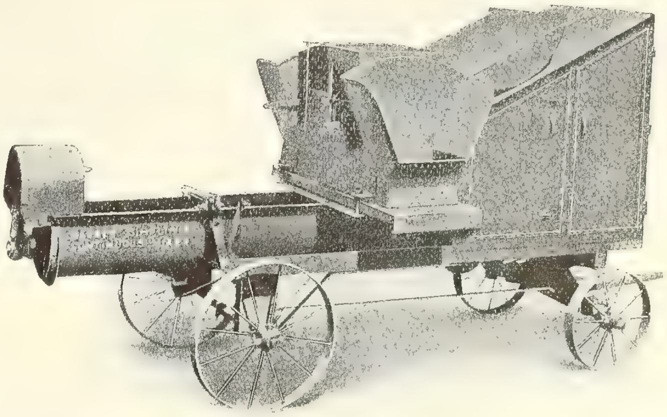

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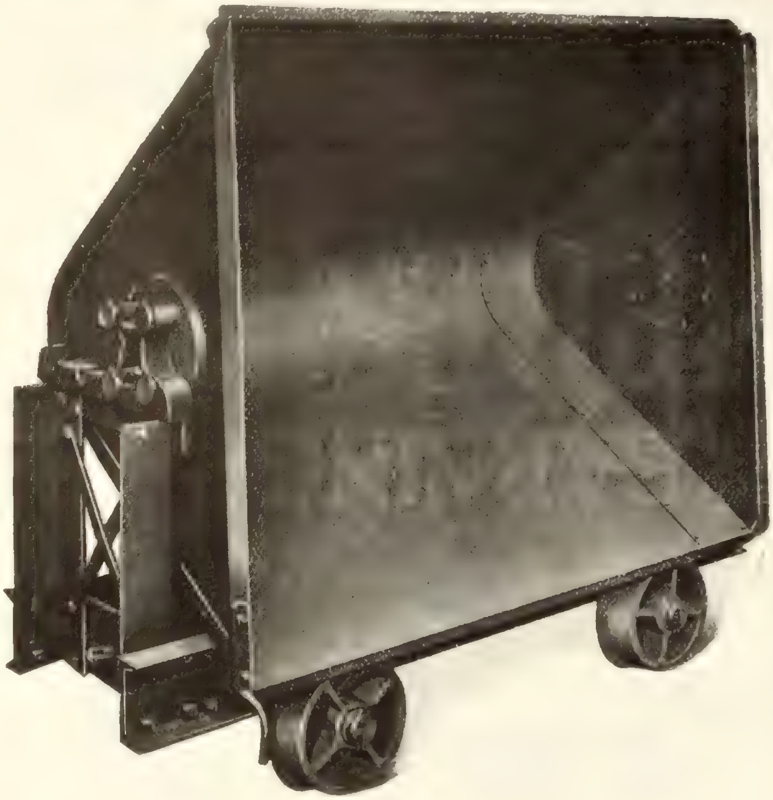

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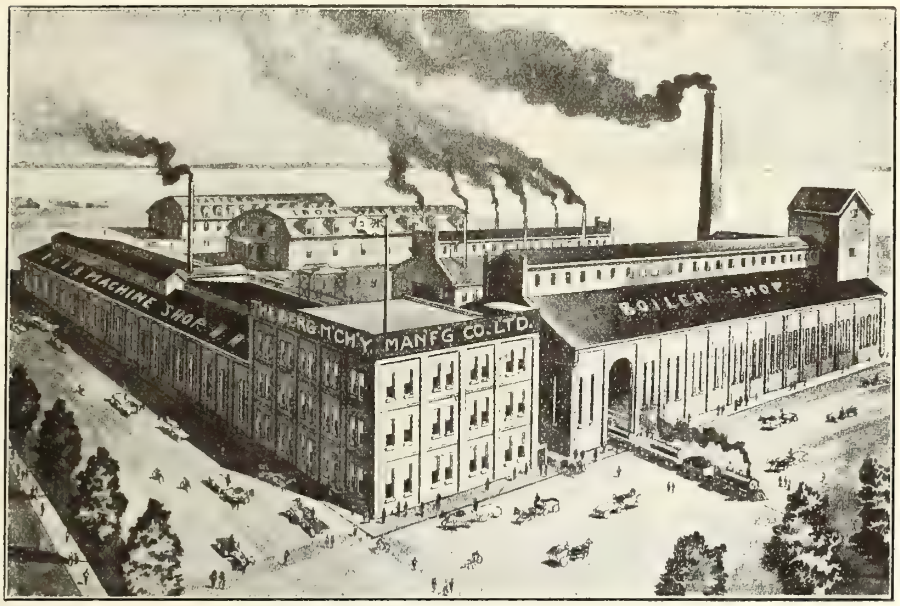

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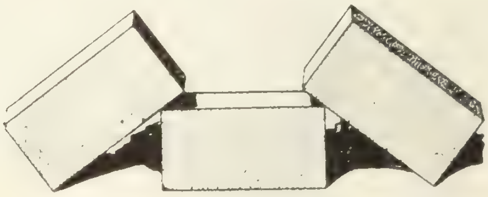

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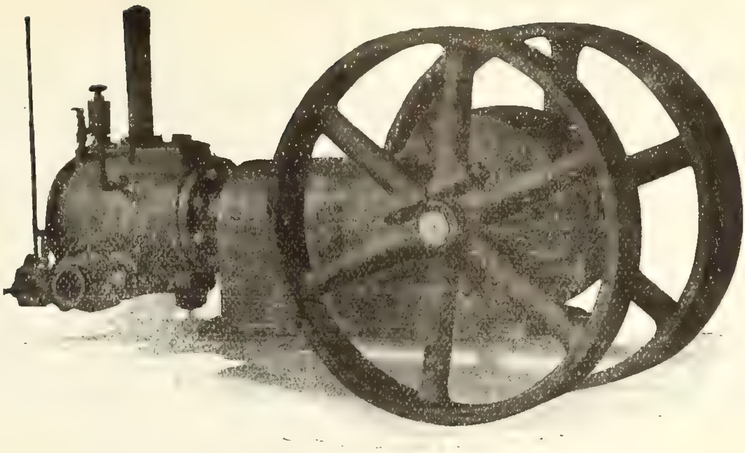

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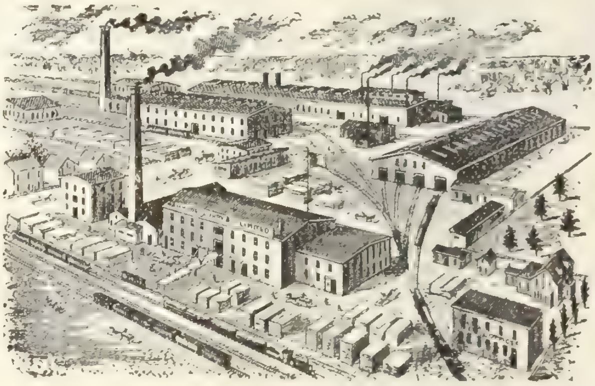

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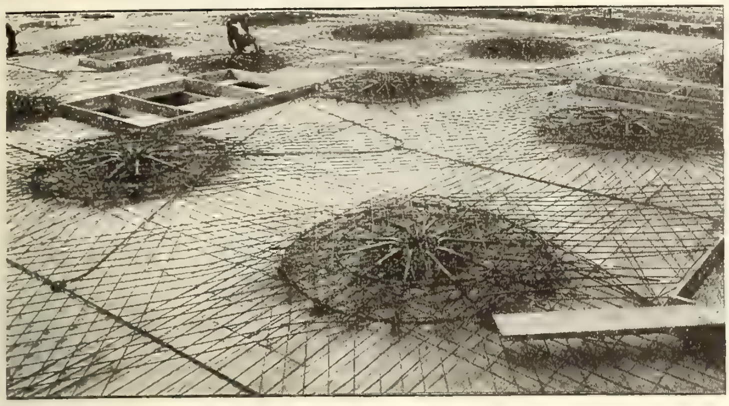

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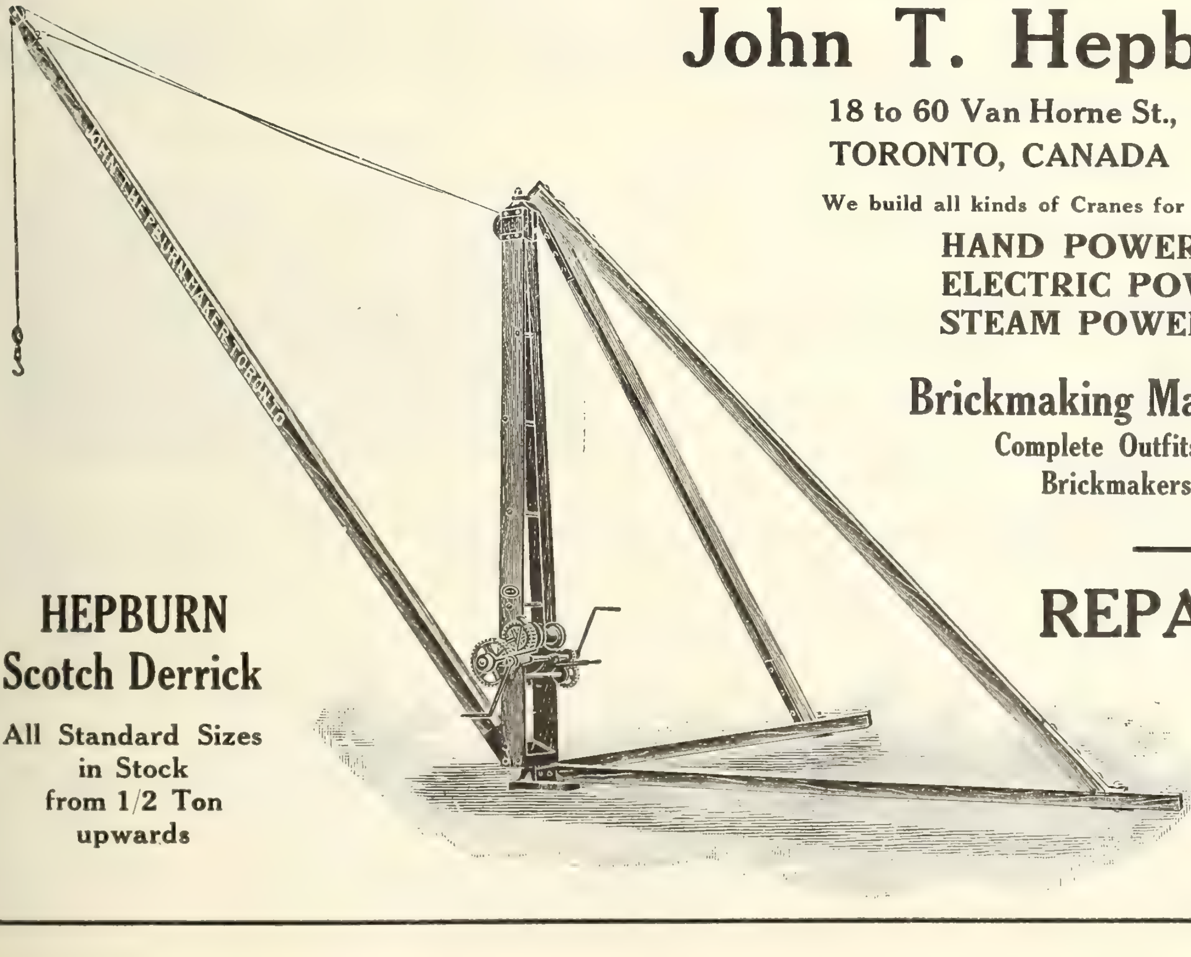
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Works at Lachine Locks, P.Q., Toronto, Ottawa and Winnipeg

The Canadian Bridge Company, Limited
WALKERVILLE, ONTARIO

Manufacturers of

Steel Buildings
Roof Trusses

Railway and Highway Bridges

Locomotive Turn Tables and Structural Steel and Iron Work of all descriptions.
Estimates furnished on application.

Neptune Meter Co.

Manufacturers of the well-known

TRIDENT
Frost-Proof
Water
Meters

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Main Office - 90 West Street
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McGregor & McIntyre
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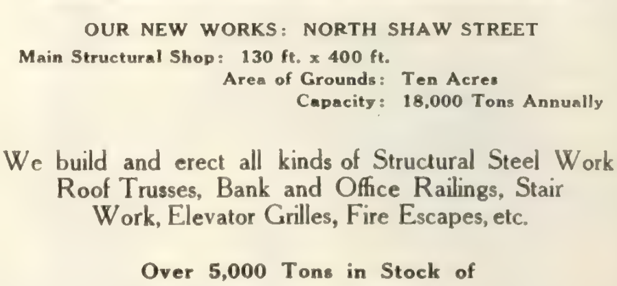
Toronto, Canada



OUR NEW WORKS: NORTH SHAW STREET
Main Structural Shop: 130 ft. x 400 ft.
Area of Grounds: Ten Acres
Capacity: 18,000 Tons Annually

We build and erect all kinds of Structural Steel Work Roof Trusses, Bank and Office Railings, Stair Work, Elevator Grilles, Fire Escapes, etc.

Over 5,000 Tons in Stock of
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Lap Welded Steel Pipe

We carry in stock
30 INCH DIAMETER
LAP WELDED STEEL PIPE

Ask for Prices

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The Des Moines Hemispherical Bottom Steel Tanks and Towers have been used and approved by nearly all leading Engineers. They are undoubtedly the most economical means of storing water at an elevation.

We have built many of these in Canada the United States and Mexico. Estimates cheerfully furnished.

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"Engineers desiring one of our Tank Calculators will receive same upon application."

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Steel Buildings and Bridges

If you are intending to purchase **Steelwork** for any purpose, it will be to **your interest** to permit us to quote.

THE DOMINION WOOD PIPE COMPANY
LIMITED
NEW WESTMINSTER, B.C.
MANUFACTURERS OF
DOUBLE WIRE WOUND

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CAST IRON SPECIALS, VALVES, HYDRANTS, ETC.

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ENAMELED BRICK

Sanitary and Impervious

Adaptable for all kinds of building where the highest standard of brick perfection is demanded.

Write for information.

AMERICAN ENAMELED BRICK & TILE COMPANY
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SARNIA - CANADA

WE ARE MANUFACTURERS OF

Structural Steel of All Kinds

Railway and Highway Bridges
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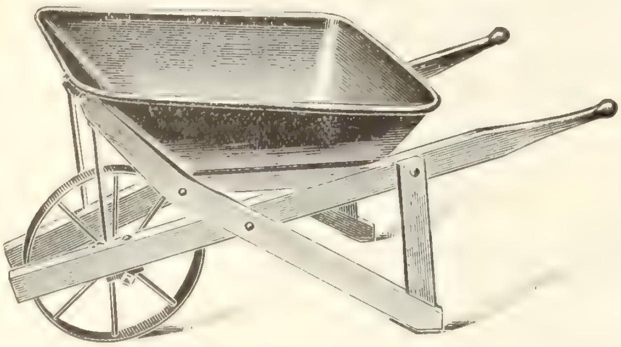
Beams, Channels, Angles, Plates
etc., in stock

ESTIMATES AND DESIGNS FURNISHED ON APPLICATION

IRON AGE



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SPECIALLY suited to the needs of contractors and workers on concrete. This barrow has a tray pressed from solid sheets of high carbon steel, without seams or joints. It can save much time and money on any concrete job.

Send for our Catalogue

THE BATEMAN-WILKINSON CO., LIMITED
340 CAMPBELL AVE., TORONTO

BUILDERS SUPPLIES

- Lime
- Portland Cement
- White Cement
- Keenes Cement
- Plaster Paris
- Hard Wall Plaster
- Mortar Colors
- Fire Brick
- Sewer Pipe
- Weeping Tile
- Sacketts Plaster Board
- Parkers Corner Bead
- Rubble Stone
- Crushed Stone, Etc.

With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

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Limited

Crown Office Building, Toronto, Ont.
Head Office Phones: Main 5472—5473

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MEXICAN ASPHALT

HERKIMER ST., HAMILTON. Paved with our Mexican Asphalt.

Write for analysis and samples

The
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Sole Canadian Agents for the Mexican Eagle Oil Co.
Also Agents for MASTIC ASPHALT for Sidewalks.

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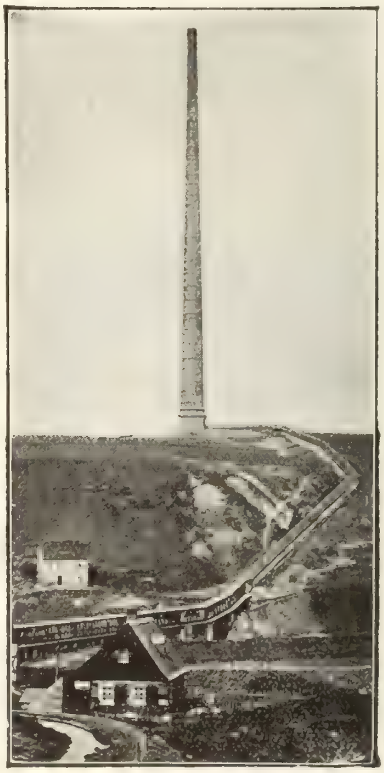

460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

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Representatives for Canada:
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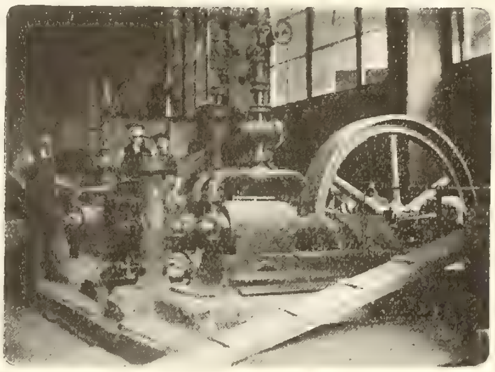
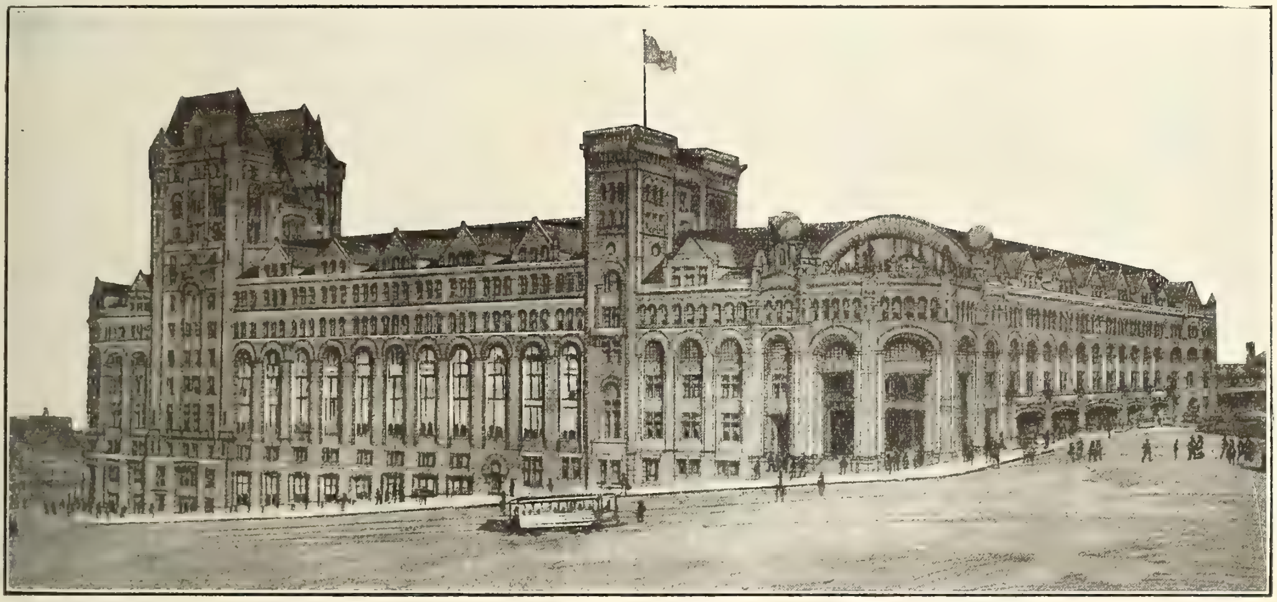
THE LINDE·BRITISH REFRIGERATION COMPANY LIMITED

has the largest output in the world of refrigerating machinery.



Plant in course of construction at Windsor Station



A RECENT INSTALLATION—C. P. R. WINDSOR ST. STATION

The largest contract for installation of refrigerating plant in any hotel or railway station in Canada

Established in Great Britain 27 Years. *Established in Canada 18 Years.*

Operating in every country in the world, with plants or distributing offices at

Liverpool	Bristol	Sydney, N. S. W.
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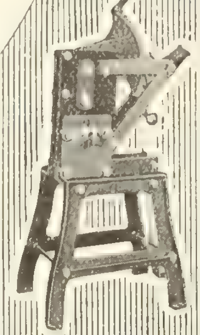
LONDON, ENG.

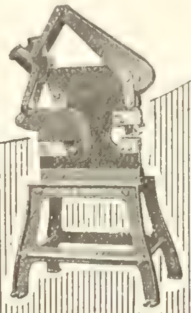
CANADIAN OFFICES
CORISTINE·BLDG
MONTREAL

"Buffalo" Punches Shears and Drills

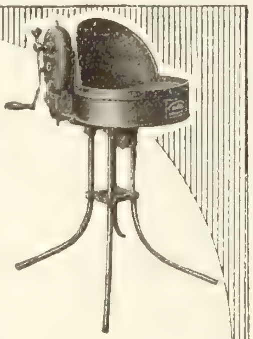
Among our recent designs is the Bar Cutter No. 10 for cutting concrete reinforced bars—twisted, round or any other shape. It cuts bars up to 1⅛" thick and, due to its steel frame, its **weight is only half** that of a cast iron machine of the same capacity. Ask for catalog of Steel Punches, Shears and Drills No. 145.

Canadian Buffalo Forge Co.
MONTREAL Limited
St. John Winnipeg
Toronto Vancouver





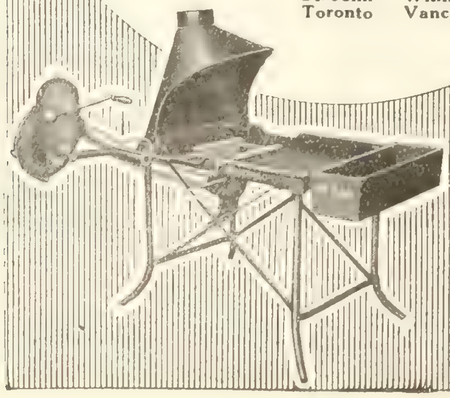
"Buffalo" Forges



"Built to Last"

is the slogan of our **1912 Rivet Forge.** The repair cost by this design is guaranteed to be actually **cut in two,** compared with any other forge now in the market. A bridge company using a large number of forges writes us regarding it: "The operator claims it runs easier and heats more rivets in less time than any forg he has ever used." Let us send you one on free trial. Fifty other styles, for light and heavy work.

Canadian Buffalo Forge Co.
Limited
Montreal
St. John Winnipeg
Toronto Vancouve



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To be
Cleaned
By
TUEC
Stationary Air-Cleaning System

One of 110 Administration Building Installations.

Canadian Factory—
B.O.T. Bldg. 159-61 Richmond St. W., Toronto

Jas. J. Martindale.

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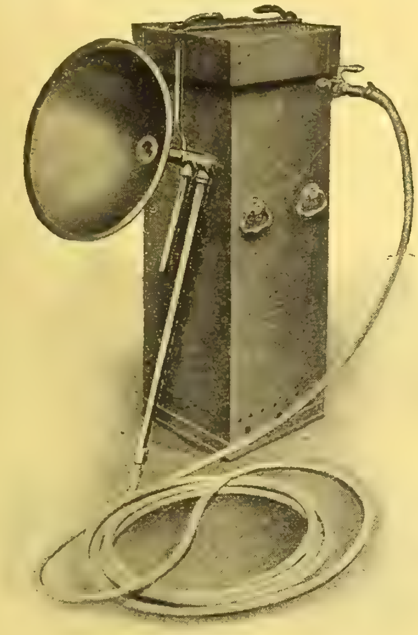
5,000 to 12,000 Candle Power at 5 cents Per Hour

How is that for cost? Can you beat it with any other light? The Milburn Acetylene Light is cheaper than oil or arc lights and just as simple as gas in your own house.



The Milburn Light shown here has a 15-inch aluminum, non tarnishing reflector, with absolutely storm-proof burner on swing joint, and 25 feet of armored hose and connections. It has a water-tight cover and is made to withstand hard usage, the vibration and movement of wrecking cars, cranes, steam shovels, dredges, etc. The light follows the crane or shovel and throws its rays directly upon the work.

THE MILBURN LIGHT

is made by water and carbide, burns more than half air, and requires no attention during use. Most of the fittings are of standard sizes, obtainable anywhere. It lights instantly and is absolutely safe. Tens of thousands of these lights are in constant use by all classes of users and not a single accident has ever been reported. They are now being used on all kinds of construction work in all parts of the world. Up-to-date contractors swear by them. You had better get acquainted with the Milburn Light.

Ask for Catalog No. 15

The Canadian Fairbanks-Morse Company, Limited

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Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Fourth of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

Electric Railway Chambers Winnipeg

This building was wired with
"Imperial Higrade" Rubber Insulated Wire

Architect; Pratt & Ross, Winnipeg.
Engineers; Neiler, Rich Co., Chicago.
Electrical Contractors; Schumacher Gray Co., Winnipeg.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd. Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA,,

Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

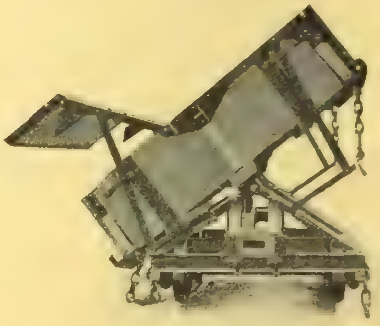
Brickyards, Quarries, Mines, Contractors, etc.

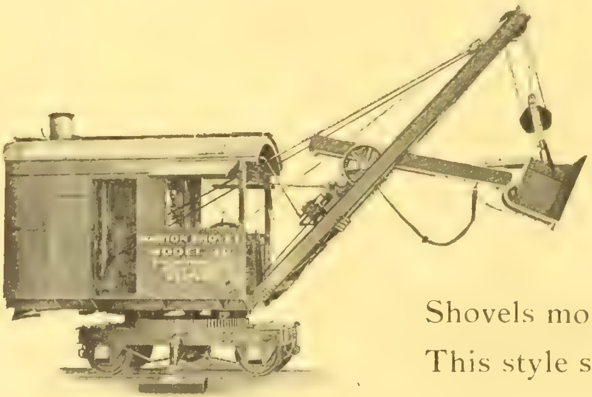
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.





"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
58 - 1 and 1 1 2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines —Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

BRANCH OFFICES: General Supply Company of Canada, Ltd., Winnipeg Agents
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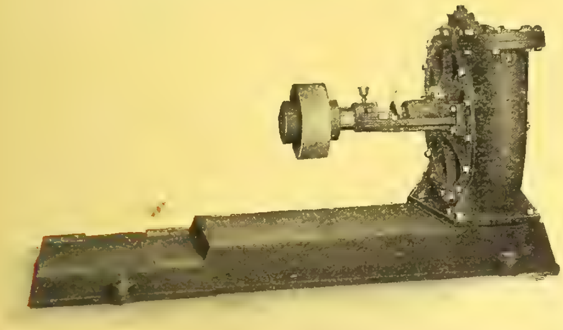
Vol. 27 Toronto, October 29, 1913 No. 44

Contract Record and Engineering Review

ESTABLISHED 1886



We manufacture all kinds of

Steam and Power Pumps

for all kinds of service, using only the best material and workmanship.

THE SMART-TURNER MACHINE CO.
HAMILTON, CANADA LTD.

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

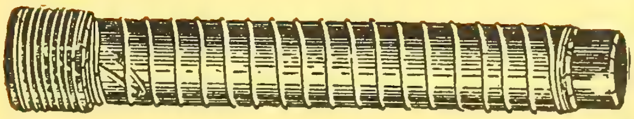
INGERSOLL-RAND

SHEET PILE DRIVERS

FOR WOOD OR STEEL SHEET PILES

This machine is comparatively light but does the work of a much heavier type owing to the careful distribution of the weight involved.

Canadian
Ingersoll-Rand
Co., Limited
MONTREAL, CAN.



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WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6

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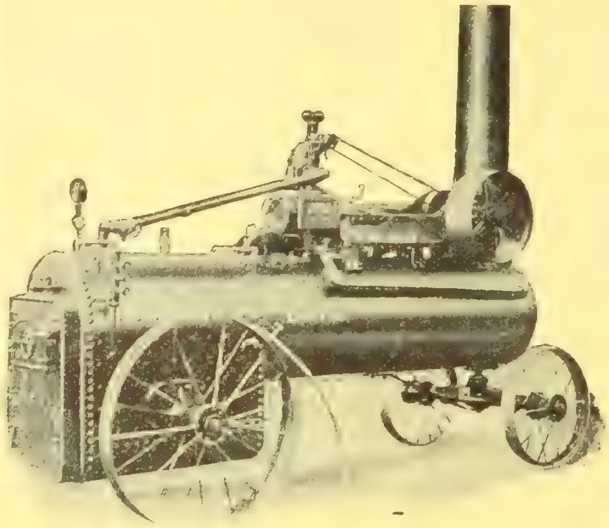

THE cut shows one of our compact and *portable* power plants for driving Crusher Outfits, etc. A complete power plant in itself—durable and efficient. We build different sizes and can meet your requirements precisely.

The Jenckes Machine Co.
Limited
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Offices:—Sherbrooke, Montreal, Toronto, St. Catharines, Cobalt, South Porcupine, Nelson, Vancouver.

Here Is One of The Most Powerful Steel Barge Derricks Ever Built

It's an "AMERICAN," of course.
50 tons is its nominal capacity.

This great barge derrick was built for the G. H. Starke Dredge and Dock Co., of Milwaukee, and is a convincing testimonial to the skill of our engineers and the efficiency of our shops.

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SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
PORTLAND
CANADA
CEMENT
MONTREAL

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

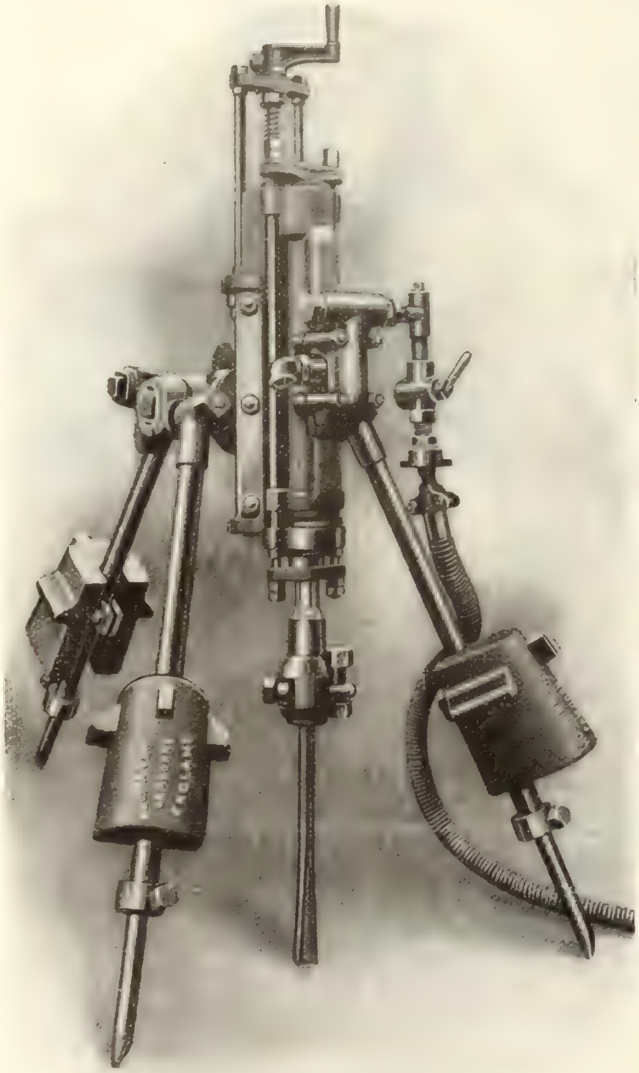
Canada Cement Company, Limited

Head Office - Montreal

Sales offices at

Montreal - Toronto - Calgary - Winnipeg

The
Holman Steel Rock Drill



will drill right into your drilling costs.

Both on the job and in competitions the Holman has proven itself to be lowest in drill maintenance, air consumption and blacksmith costs and highest in footage obtained.

Holman Drills cost no more than other standard makes of drills for the initial installation.

Carried in stock

The Drill you will finally buy

Mussens Limited

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COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 365 Water Street

QUEBEC, 71 Maple Ave.
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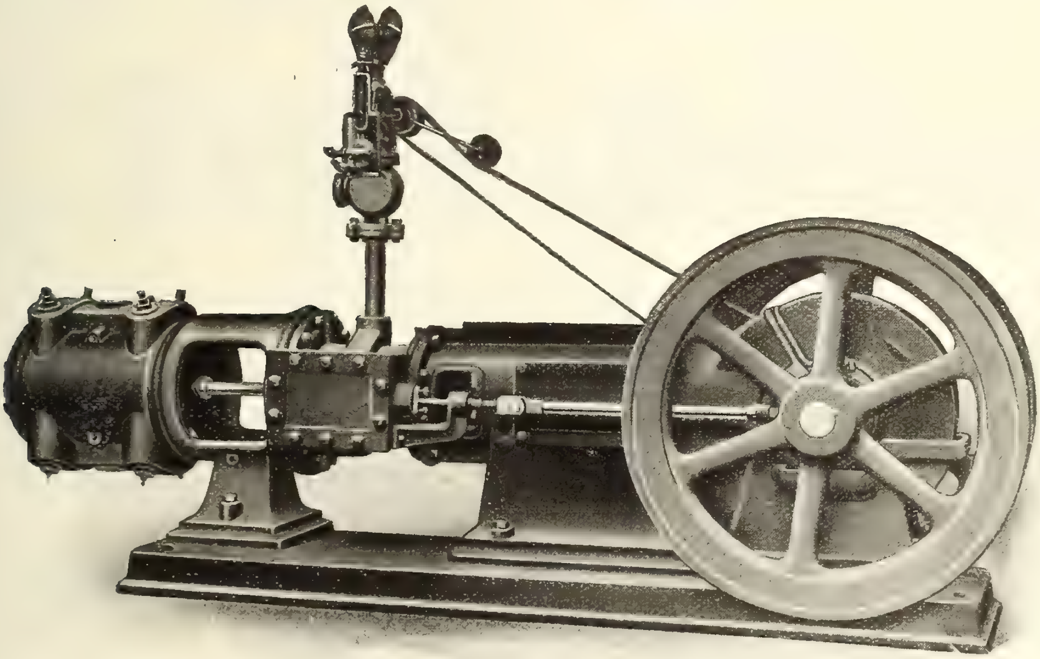
Laidlaw-Dunn-Gordon Compressors may be adopted for all services. Let us know your particular requirements and we will send you descriptive matter.



Enclosed Frame, Single Straight Line, Steam Driven Laidlaw-Dunn-Gordon Air Compressor with Splash Lubrication

Built for economy in power and maintenance, durability, efficiency, accessibility, etc., etc.

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Galt Engineering Co., John
Lea & Ferguson.
Mitchell, C. H.
Thorold Co., F. W.

Expansion Bolts
Star Expansion Bolt Co.

Expanded Metal
Mannesmann Tube Co.

Exhaust Heads
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.

Field Instruments
Gurley, W. & L. E.

Filters
American Water Softener Co.

Fire Brick
Improved Equipment Co.
Ontario Lime Co., Ltd.
Smyth & Ryan.

Fire Escapes
McGregor & McIntyre

Fireproof Doors and Windows
Feather & Roadhouse
Metal Shingle & Siding Co.
Mussens Limited
Ormsby Co., Limited, A. B.
Steel & Radiation Ltd.

Fixtures (Gas)
Consumers Gas Co.

Fuse (Safety Blasting)
Lecky & Collis

Forges
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.

Furnaces (Special)
Improved Equipment Co.

Gasoline Engines
Wettlaufer Bros.

Gas Plants Complete
Improved Equipment Co.

Gas Producers for Heating
Improved Equipment Co.

Gas Machinery
Improved Equipment Co.

Glass
Consolidated Glass Co.
Hobbs Mfg. Co.
Luxfer Prism Co.
Toronto Plate Glass Imp't'g Co

Hammer Drills
Canadian Ingersoll-Rand Co.

Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited

High Pressure Pipe Lines
Boving Company of Canada
Escher Wyss & Co.
Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Engineering Co.
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Jenckes Machine Co.
Hopkins & Co., F. H.
Lecky & Collis.
Marsh & Henthorn
Mussens Limited
Royce Limited
Sturtevant Co. of Can. Ltd. B. F.

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Wettlaufer Bros.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

(Continued on page 12)

Headquarters, Fire Department, Adelaide St. West, Toronto

Don Valley Bricks

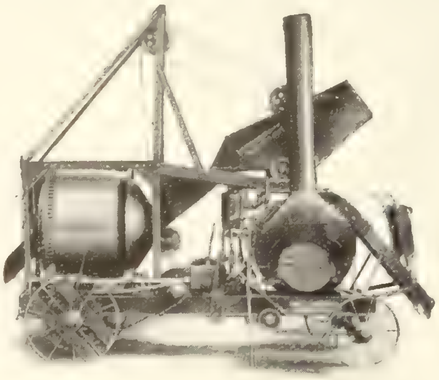
The above building erected under the supervision of Toronto's city architect is built of Don Valley Clay Products.

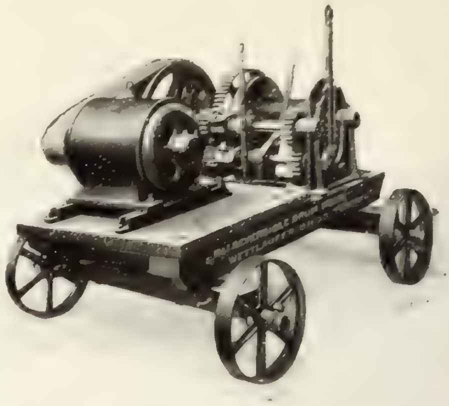
Don Valley Eatonia Brick was used for the outer walls and the building is fireproofed throughout with Don Valley Porous Terra Cotta. The result is an imposing fireproof building that will look as fresh and clean cut in twenty years as it does today.

For pleasing and permanent effects in brickwork
Specify "Don Valley Brick."

Don Valley Brick Works

Toronto, Ontario





Wettlaufer

Mixers and Hoists

Illustrated is the famous Wettlaufer Horizontal Tubular Boiler Mixer with the Heart Shape Drum. The mixer is built of stee throughout. It cannot upset because of the even distribution of the load. The Drum can be thrown out of gear when tractioning or when not in use.

Loading skip comes flat down to the ground, making easy loading.

The Wettlaufer reversible single drum motor driven hoist, mounted on trucks or skids, is indispensable equipment to every contractor. It is a handy, powerful, little hoist.

Daily demonstrations at all our branches — attend one

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L. Lachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagauchetiere St. W., Montreal.

Rogers' Portland Cement

AND CRUSHED STONE

The most dependable for all types of construction and engineering-contracting work — especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, &c.

Rogers' Brands:

PYRAMID DORIC SUPERIOR
STERLING SAUGEEN

Mills at:

KIRKFIELD ST. MARY'S HANOVER
ORANGEVILLE OWEN SOUND

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

Concrete Tank at Berlin, Ont.
BUILT WITH ROGERS' CEMENT.
L. J. MENSCH, M. Am. Soc. C.E., CHICAGO, ILL.
Engineer and General Contractor.

Crushed Stone

Our crushed stone is free from dust, dirt and mold—it is really clean stone—properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

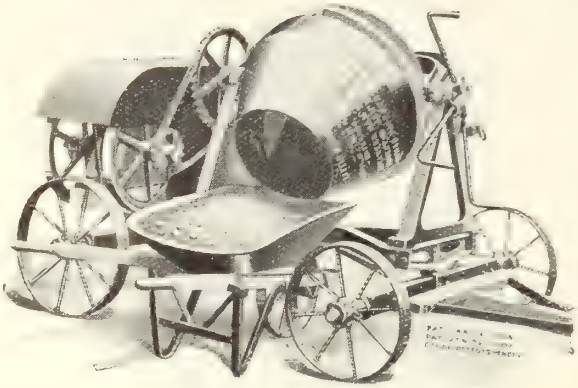
Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

Grasp this Idea



Little Wonder "Five" without Side Loader

You have to make money faster these days than ever before. You must do it by making time.

SPEED, EFFICIENCY, UTILITY--these are the keys to success. These are the winning features in WONDER Concrete Mixers. Not to know the machines is to be behind the times. Not to take advantage of them is to neglect a real opportunity.

LITTLE WONDER "FIVE"

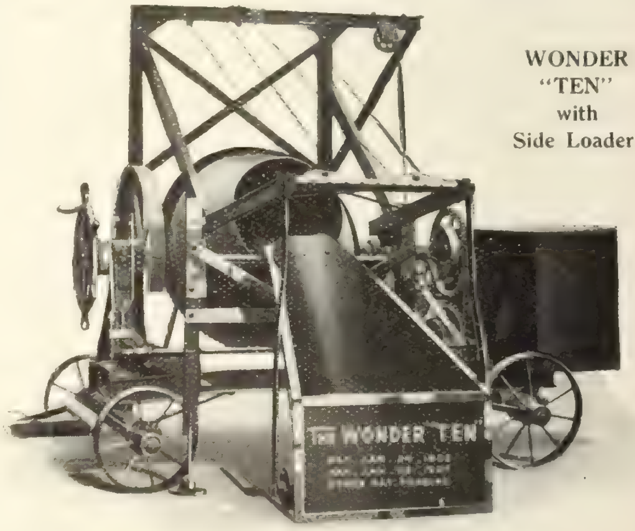
"The Small Job Money-Maker"

THE WONDER "TEN"

"The Big Job Money-Saver"

THE LITTLE WONDER "FIVE" is the swiftest, simplest, strongest mixer ever known for building sidewalks, curbs, drives, foundations, etc. Saves 50 cts. per cu. yd. over hand mixing and pays for itself in a few days by its profits. Capacity 5 cu. ft, per batch. Mixes 35 to 50 cu. yds. per day. Side Loader practically doubles this capacity with only small extra investment. Endorsed by thousands of contractors all over the country.

The WONDER "TEN" is a 1-3 yd. "Sack to the Batch" mixer for **heavy work.** It will do the work of machines costing two or three times the price and make twice the money by its speed and greater utility. Embodies the same unique features that have made the LITTLE WONDER "FIVE" the fastest seller in the history of the concrete business.



WONDER
"TEN"
with
Side Loader.

TEN DAYS' FREE TRIAL

We will send you either size of the WONDER, with or without Side Loader, for Ten Days' Free Trial on your own work. If you're not fully satisfied with the machine in every particular, notify us within the ten days and we will tell you where to ship it and refund the freight you have paid. You are under no obligations whatever.

All we ask is to show you. Write TODAY

WATERLOO CEMENT MACH'Y CORP'N

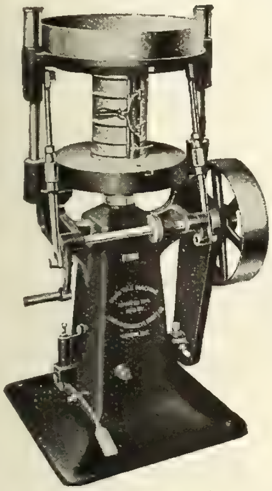
117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists, Elevators and Cement Tools

CANADIAN REPRESENTATIVES:—Waterloo Cement Mach'y Corp'n, 127 Coristine Building, Montreal, Que.; General Mach'y Co., 22 Mulock Ave., Toronto, Ont.; J. W. Anderson, 3 Bank St. Chambers, Ottawa, Ont.; J. A. McTaggart & Co., Winnipeg, Man.; Strumbert, Virtue & Co., 319 Pender St., Vancouver, B.C.

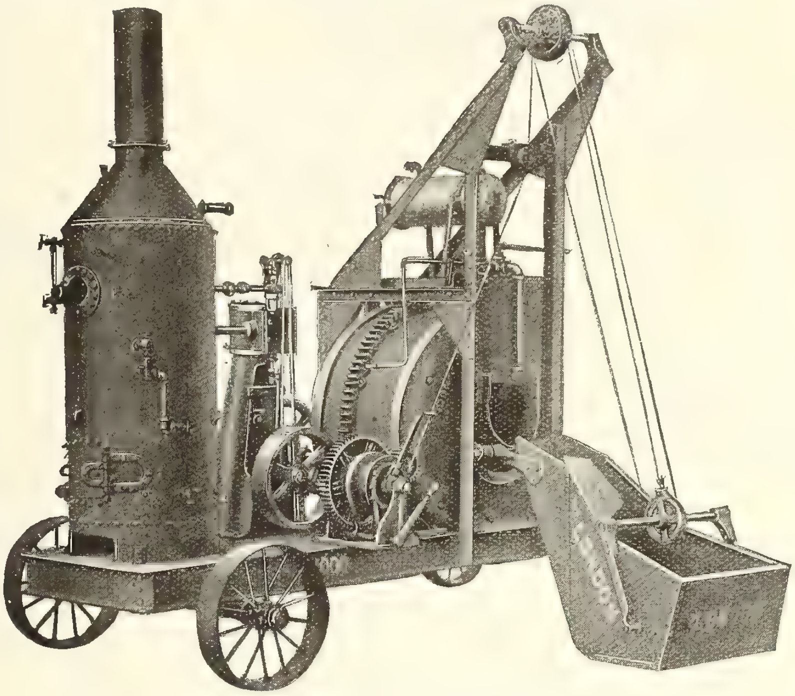
LONDON CONCRETE MACHINERY

Is Not Built Down to a Price, but Up to a Standard.



Dunn Cement Drain Tile Machine

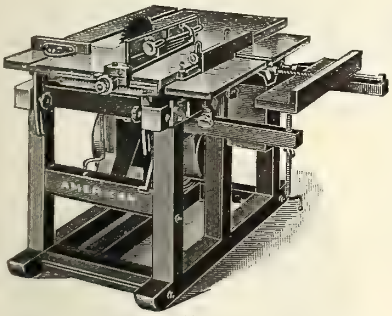
We Cannot Afford to Make anything but the Best.



London Standard Drum Batch Mixer

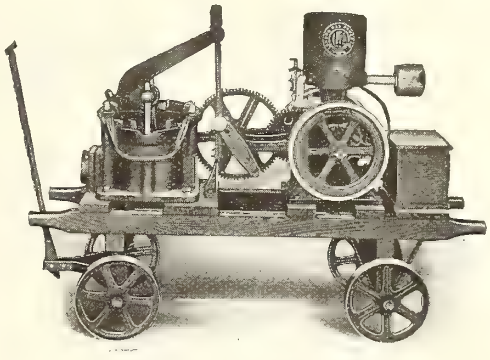
There are Large Profits in the manufacture of Cement Drain Tile.
Write for Particulars.

Over 600 London Concrete Mixers sold in Canada in Three Years.



Variety Woodworker

No Contractor can afford to be without a Variety Woodworker



Diaphram Pump with Power

We manufacture a complete line of Contractors' Machinery: Concrete Mixers, Hoisting Engines, All kinds of Pumps, Block Machines, Brick Machines, Tile Moulds, Derricks, Cars, Ornamental Moulds, Wheel Barrows, Carts, Scrapers and Cement Working Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:
WINNIPEG (445 Main St.) W. H. Rosevear, Mgr. CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (60 Richmond St.E.) F. D. Emsley, Mgr.

AGENCIES:
VANCOUVER, B. C. Equipment Co. MOOSE JAW, Sask. Bridge & Iron Co., Ltd. REGINA, H. A. Knight
FORT WILLIAM, Northern Eng. & Supply Co. MONTREAL, Foss & Hill Mach. Co. QUEBEC, A. D. Masson

We are the Largest Manufacturers of Conorete Machinery in Canada

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

- **Ice-making Machinery**
  - Linde British Refrigeration Co.
- **Insulating Compounds**
  - Standard Underground Cable Co. of Canada, Limited
- **Interior Finish and Doors**
  - Batts Limited
  - Canada Office & School Fur. Co.
  - Rhodes Curry & Co.
- **Kilns**
  - Canadian Buffalo Forge Co.
  - Sheldons Limited
  - Sturtevant Co. of Can. Ltd. B. F.
  - Canadian Sirocco Co.
  - Berg Machinery Mfg. Co.
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  - Ontario Lime Co., Ltd.
- **Lime Kilns**
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  - Dominion Marble Co.
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  - Greening Wire Co., B.
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  - Ferranti Electrical Mfg. Co.
  - Canadian Allis-Chalmers
- **Meters, Water**
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  - McDougall Caledonian Iron Wks.
  - Neptune Meter Co.
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  - Goheen Mfg. Co.
  - Ottawa Paint Co.
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  - Greening Wire Co., B.
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  - Canadian Allis-Chalmers, Ltd.
  - Canadian Pipe Co.
  - Dominion Concrete Co.
  - Dominion Wood Pipe Co.
  - Gartshore-Thomson Pipe Co
  - Munderloh & Co.
  - National Iron Works
  - National Pipe & Foundry Co.
  - Pacific Coast Pipe Co.
  - Piggott & Co., Thos.
  - United States Cast Iron Pipe & Foundry Company
  - Walsh Plate & Structural Works
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  - Browning Engineering Co.
  - Canadian Ingersoll-Rand Co.
  - Lecky & Collis
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  - Pittsburgh Valve, Foundry & Construction Company
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  - Canadian Buffalo Forge Co.
  - Sheldons Limited
  - Canadian Sirocco Co.
- **Plug Drillers**
  - Canadian Ingersoll-Rand Co.
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  - Britnell & Company
  - Ontario Lime Co., Ltd.
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  - Mueller Mfg. Co., H.
- **Plumbing**
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- **Portable Track**
  - Bechtels Limited
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  - Jenckes Machine Company
  - Canadian Allis-Chalmers, Ltd.
  - Waterous Engine Works
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  - Beatty & Sons, M.
  - Boving Company of Canada.
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Buffalo Forge Co.
  - Canadian Fairbanks-Morse Co.
  - Canadian Ingersoll-Rand Co.
  - Cook, A. D.
  - Hamilton Mfg. Co., Wm.
  - Hopkins & Co., F. H.
  - Inglis & Company, John
  - McDougall Caledonian Iron Wks.
  - Smart-Turner Machine Co.
  - Waterous Engine Works Co.
  - Mussens Limited
  - Ontario Wind Eng. & Pump Co.
  - Wettlaufer Bros.
- **Quarry Machinery**
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Ingersoll-Rand Co.
  - Improved Equipment Co.
  - Lecky & Collis
  - George Anderson & Co.
- **Railway Supplies**
  - Gartshore, John J.
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  - Lecky & Collis
  - Mussens Limited
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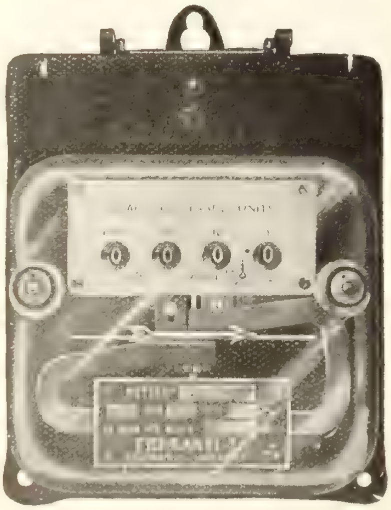
  - Linde British Refrigeration Co.
- **Reinforcements, Concrete & Steel**
  - Canada Steel Co., Ltd.
  - Canada Wire & Iron Goods Co.
  - Greening Wire Co., B.
  - Steel Company of Canada
  - Steel & Radiation Ltd.
  - Trussed Concrete Steel Co.
  - Turner, C. A. P.
- **Revolving Stone Screens**
  - Greening Wire Co., B.
- **Road Asphalt**
  - Barber Asphalt Paving Co.
  - Asphalt & Supply Co
- **Road Machinery**
  - Dore & Fils
  - Erie Machine Shops
  - Lecky & Collis
  - Morrison & Co., T. A.
  - Mussens Limited
  - Waterous Engine Works Co
  - Western Wheeled Scraper
- **Road Oil**
  - Baker, John, Jr.
- **Road Plows**
  - Shunk Plow Company
- **Roofing Material**
  - Asbestos Mfg. Company
  - Barber Asphalt Paving Co.
  - Bird & Son, F. W.
  - Can. H. W. Johns-Manville Co
  - Can. Supply & Contracting Co.
  - Metallic Roofing Company
  - Noble, Clarence W.
  - Paterson Mfg. Co.

(Continued on page 14)

Ferranti Meters



Glass Case—Top Connections

Simplicity of construction.

Perfect accuracy.

Cyclometer or clock dials.

Top or bottom connections.

Prompt deliveries.

Every meter carefully inspected before shipment.

Absolutely guaranteed.

Send us your probable meter requirements and let us make you a proposition.

Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

Steel Case—Top or Bottom Connections

The Ferranti Electrical Co., of Canada, Limited

TORONTO
90 Sherbourne St.

WINNIPEG
56 Albert St.

Goold, Shapley & Muir Co.
Limited
Brantford Winnipeg Regina Calgary

Towers and Tanks for all purposes.

Concrete Mixers

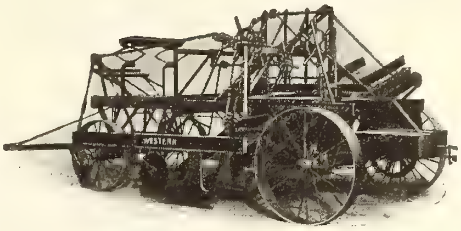
Gas and Gasoline Engines

Hoists

Windmills

Water supply outfits of every description.

CORRESPONDENCE SOLICITED



ALL OVER THE WORLD

Contractors, highway officials and others engaged in earth handling are now using the Western Elevating Grader. These graders will move 1000 cubic yards per day. If you have any ditches to excavate, wagons to load or canals to build, you can save money by using the

Western Elevating Grader

Numbers of these graders are used in railroad work and in building canals for irrigation work.

Let us send you our new catalog giving full details

Western Wheeled Scraper Co.
Earth and Stone Handling Machinery
Aurora, Illinois

Hagersville Crushed Stone

The Toughest Stone for Macadam in Ontario

Record of Logan Avenue, Toronto, Macadamized from Queen St. to Gerrard St., in 1902
Length 2,454 Lin. Ft. Width 24 Lin. Ft. 6,550 Sq. Yds.

COST FOR REPAIRS

1903	$ 0.00	1908	$ 93.26
1904	3.30	1909	200.46
1905	9.35	1910	14.07
1906	37.33	1911	2.29
1907	16.11		

Total $376.17 or 5⅔c. per sq. yd. for repairs for nine years, a little over 6-10 of 1c. per sq. yd. per year.

Why Not Use Hagersville Stone and Get These Results?

Hagersville Contracting Co.
Hagersville, Ont. Limited

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Taylor, J. & J.

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Sand and Supplies Limited
York Sand and Gravel Co.
Alfred Rogers Limited

Scraper Blades
Shunk Plow Company

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Weller Mfg. Co.

Sewer Joint Asphalt
Canadian Mineral Rubber Co.

Sewer Pipe
Britnell & Company
Canada Iron Corporation
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
National Iron Works
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.
Nova Scotia Clay Works Ltd.

Sewer Trenching
Lecky & Collis

Sound Deadening
Cabot Inc., Samuel

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Mussens Limited
Thew Automatic Shovel Co.

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Des Moines Bridge Co.
Hamilton Mfg. Co., Wm.
Walsh Plate & Structural Works

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Lundy Shovel & Tool Co.

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Cabot, Inc., Samuel
Pinchin, Johnson & Co.

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McGregor & McIntyre

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Canadian Buffalo Forge Co.
Pittsburgh Valve, Foundry & Construction Company
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.

Steel Tubes
Mannesmann Tube Co.

Steam Turbines
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McDougall Caledonian Iron Wks.

Steel
Canada Steel Co., Ltd.
Dominion Steel Castings Co.
Lecky & Collis

Steel Bars
Canada Steel Co., Ltd.
Steel Co. of Canada
Steel & Radiation, Ltd.

Stone
Britnell & Company
Brodie, James
Consolidated Stone Company
Contractors' Supply Company
Crushed Stone, Limited
Hagersville Contracting Co.
Mahan & Company
McMillan & Son, W.
Morrison & Co., T. A.
Myers Oakley
Ontario Lime Co., Ltd.
Queenstown Quarry Co.
Rogers Supply Company
Sackville Freestone Company
Sand & Supplies
Smyth & Ryan

Stone Saws
Anderson, Geo.

Store Fronts
Zouri Drawn Metals Co.

Structural Iron and Steel
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Canada Steel Company
Chicago Bridge & Iron Works
DesMoines Bridge Company
Dominion Bridge Company
Dominion Steel Castings Co.
Hamilton Bridge Works Co.
Mackinnon Holmes & Co.
Maritime Bridge Company
McGregor & McIntyre
Phoenix Bridge & Iron Works
Reid & Brown
Sarnia Bridge Company
Steel Company of Canada
Structural Steel Company
Standard Steel Construction Co.
Walsh Plate & Structural Wks.

Submarine Drills
Lecky & Collis

Swinging Gears
Dake Engine Company

Tanks and Stand Pipes
Chicago Bridge & Iron Works
DesMoines Bridge Company
Hamilton Mfg. Co., Wm.
Inglis, John
Jenckes Machine Co.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
Ontario Wind Eng. & Pump Co.
Piggott & Co., Thos.
Walsh Plate and Structural Wks
Waterous Engine Works Co.

Testing and Inspecting Bureau
Hunt & Co., Robt. W.

Underground Conduit
Dietrich Limited

Ventilating & Heating Apparatus
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
Canadian Sirocco Company

Vacuum Cleaners
Tuec Company
Canadian Allis-Chalmers, Ltd.
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company
Pittsburgh Valve, Foundry & Construction Company

Varnishes—Insulating
Standard Underground Cable Co. of Canada, Ltd.

Wall Board
Bird & Son, F. W.

Waterproofing
Cabot Inc., Samuel
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Ceresit Waterproofing Co.
Pinchin, Johnson & Company
Wadsworth Howland Co.

Water Softeners and Filters
American Water Softener Co.

Water Tapping Machine
Mueller Mfg. Co., H.

Water Turbines
Canadian Allis-Chalmers, Ltd.
Boving Company of Canada
Escher Wyss & Co.
Hamilton Mfg. Co., Wm.
McDougall Caledonian Iron Wks.

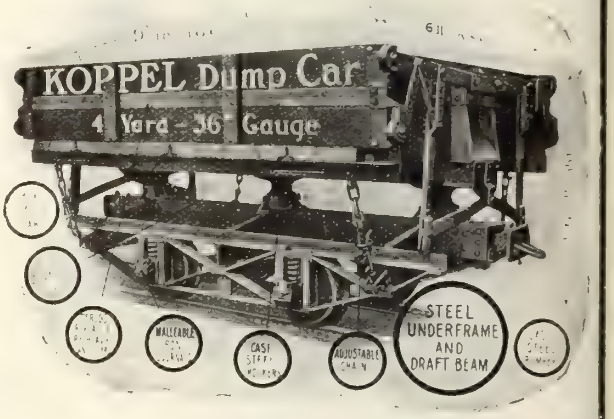
Wires and Cables
Canada Wire & Cable Co.
Imperial Wire & Cable Co.
Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
Canada Wire & Iron Goods Co.
Greening Wire Co., B.
Steel Company of Canada

Wire Rope
Canada Wire & Cable Co.
Greening Wire Co., B.
Steel Company of Canada

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Tarvia

Preserves Roads
Prevents Dust~

Section of Government Parkway, Ottawa, Canada, treated with "Tarvia B."

Dust is Expensive

When an automobile speeds down an ordinary macadam road it leaves in its wake a cloud of dust which is carried by the winds over the neighboring fields, houses and lawns.

This is just as surely a waste of good material as if the automobilist dug material out of the highway and carted it away. Dust represents waste—costly waste—and the taxpayers feel the result. A road that is properly built for modern traffic will not be dusty.

Plain macadam gives way under the wear and tear of heavy rubber-tired automobile wheels and the surface binder of the road is torn away in the form of dust, until in time the coarse stone itself is exposed and a costly renewal of the road is necessary.

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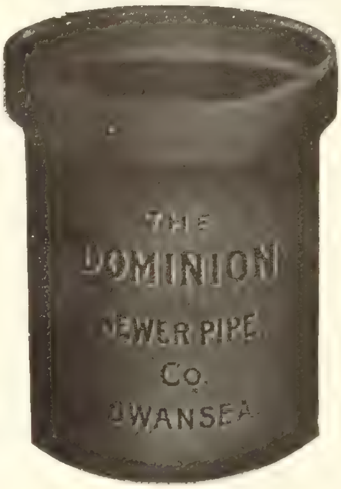

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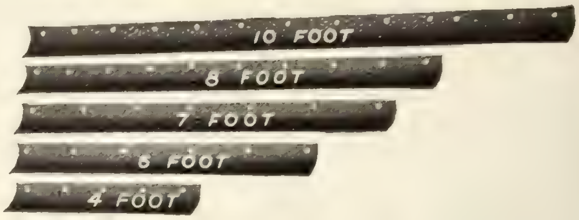

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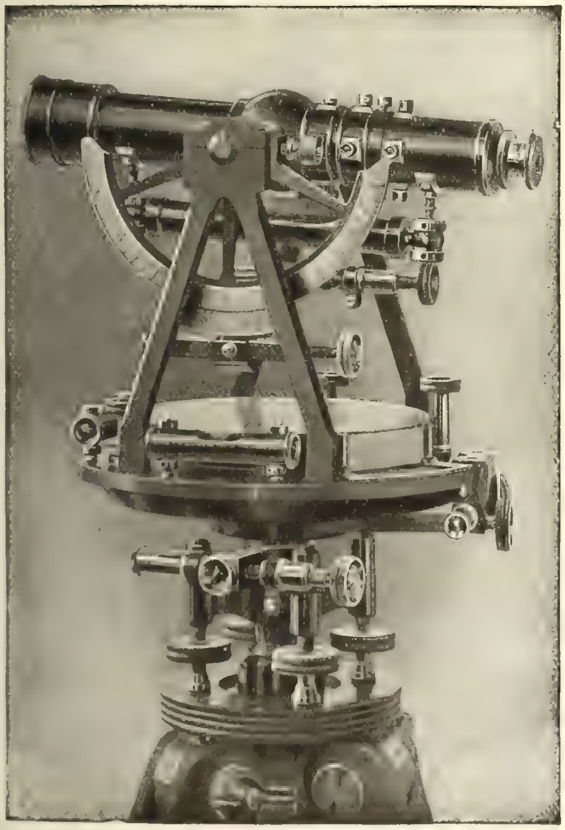

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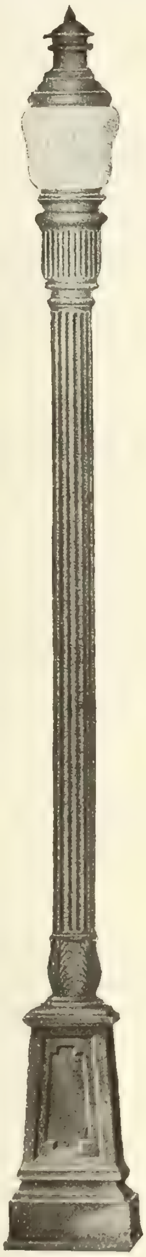

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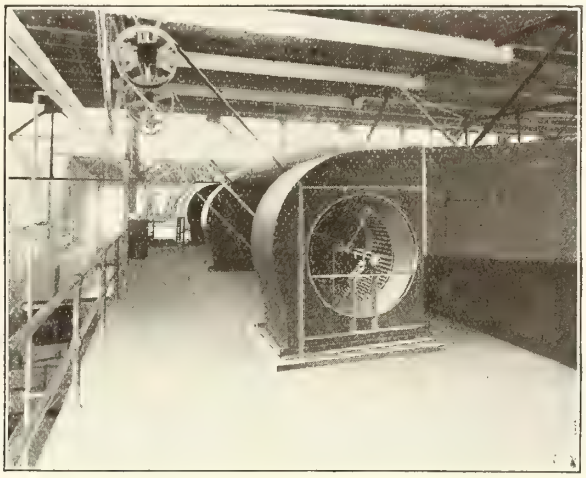

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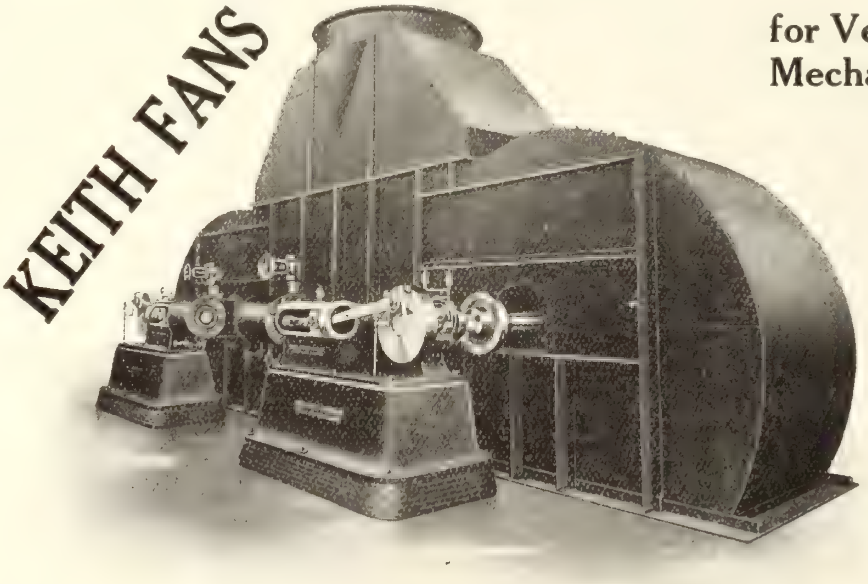

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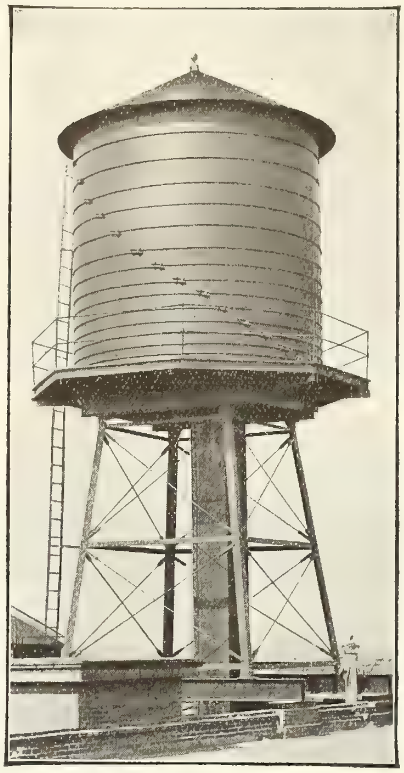

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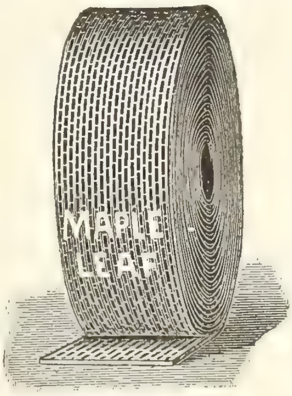

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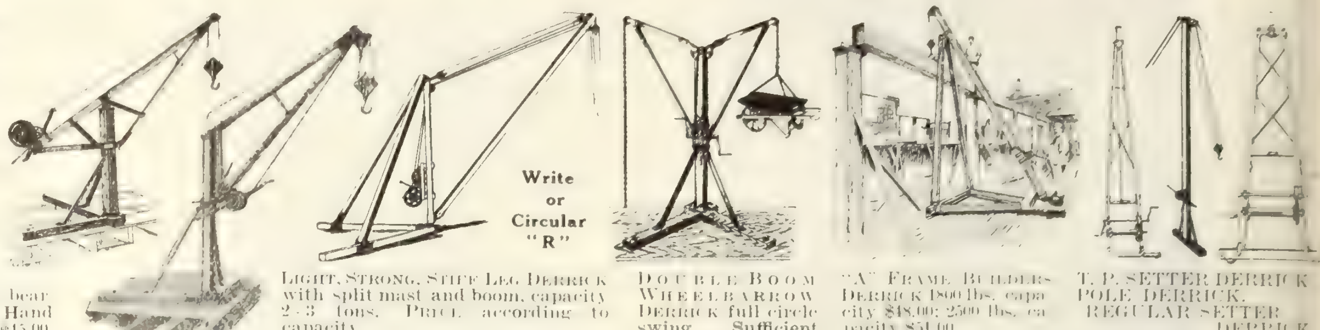

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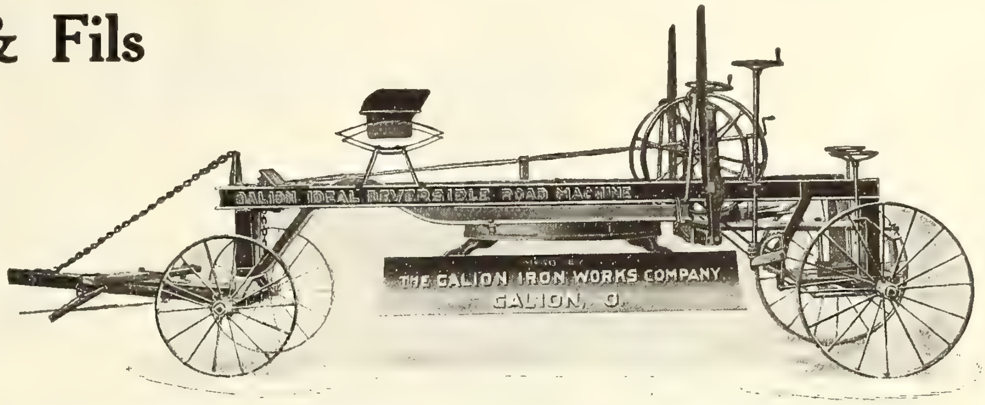
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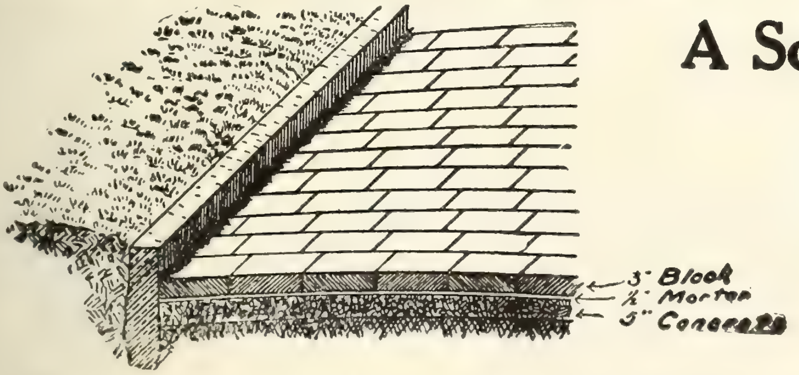

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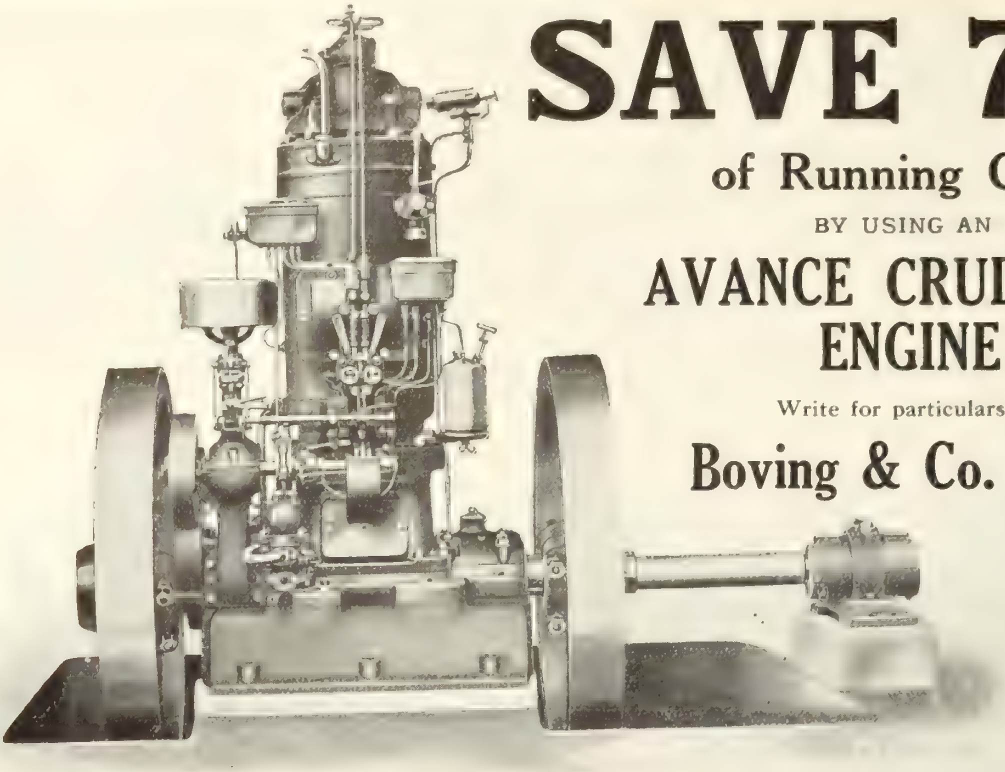

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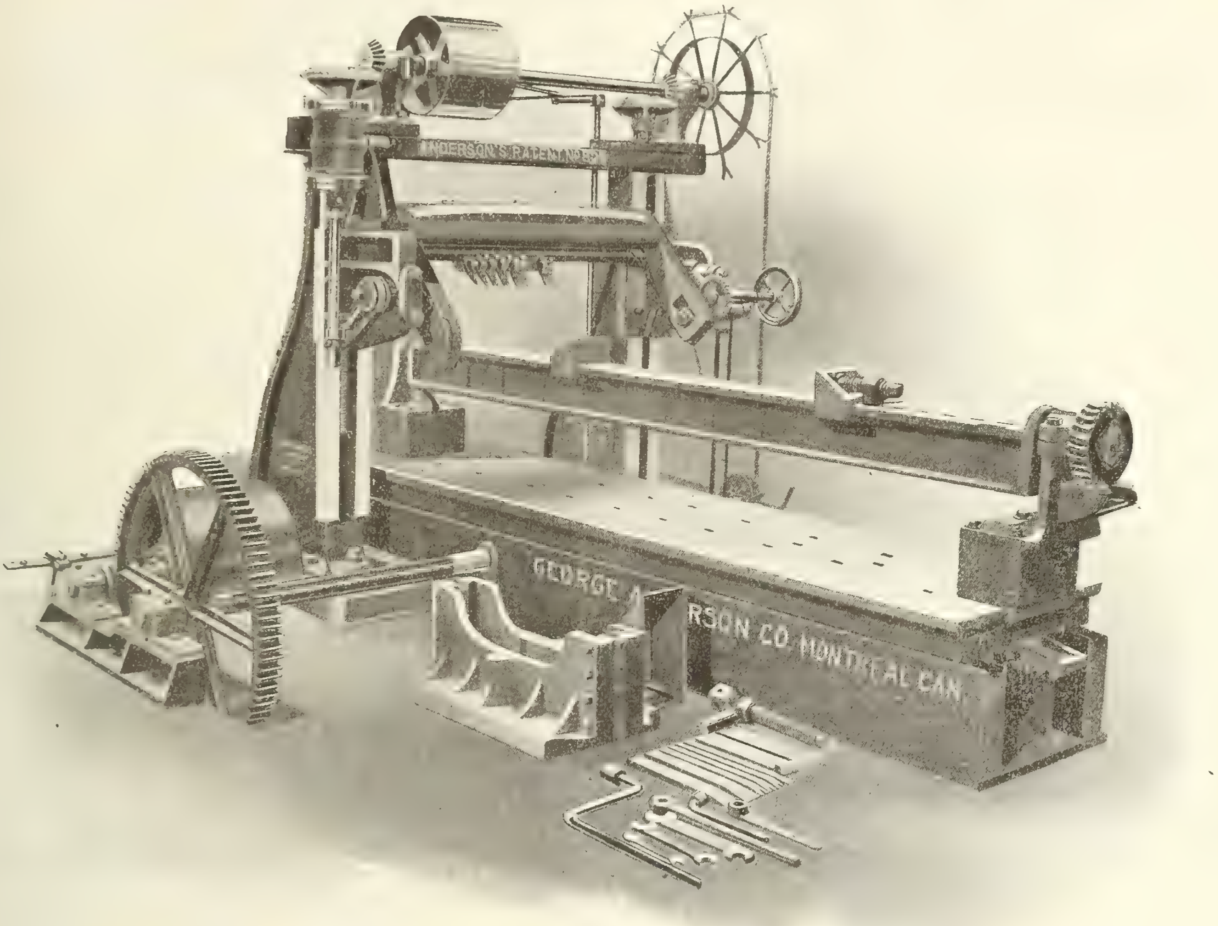

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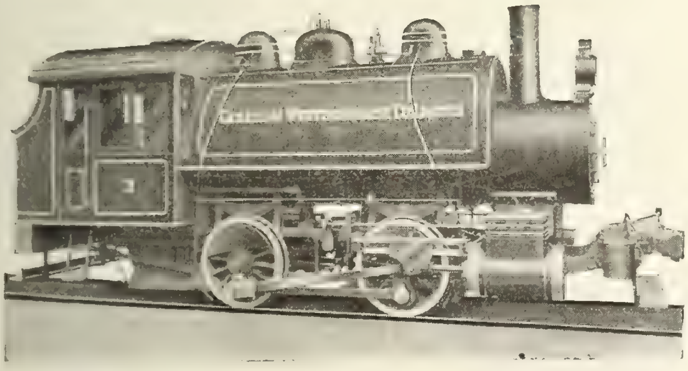

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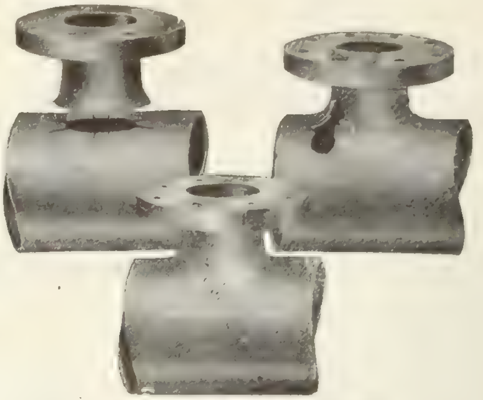

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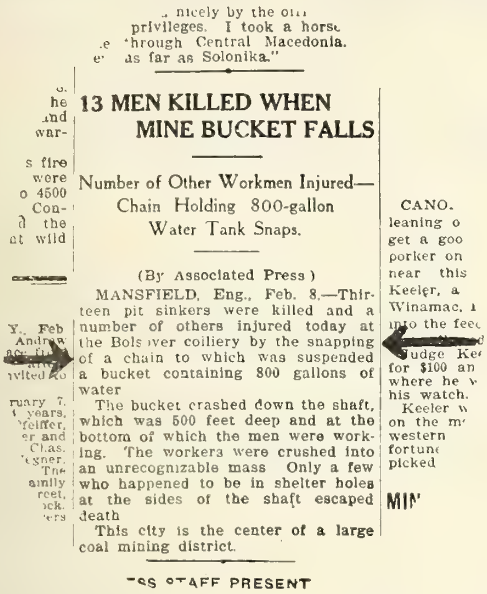

nicely by the old privileges. I took a horse through Central Macedonia as far as Solonika."

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(By Associated Press)

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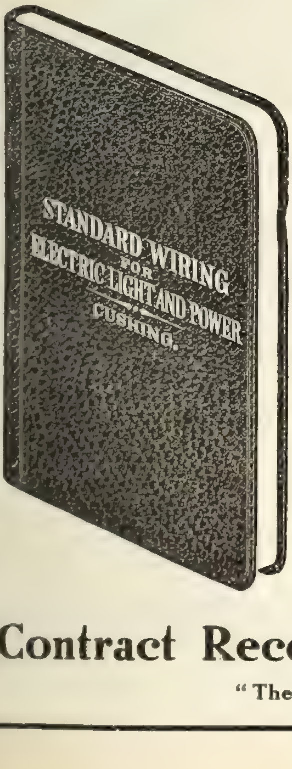

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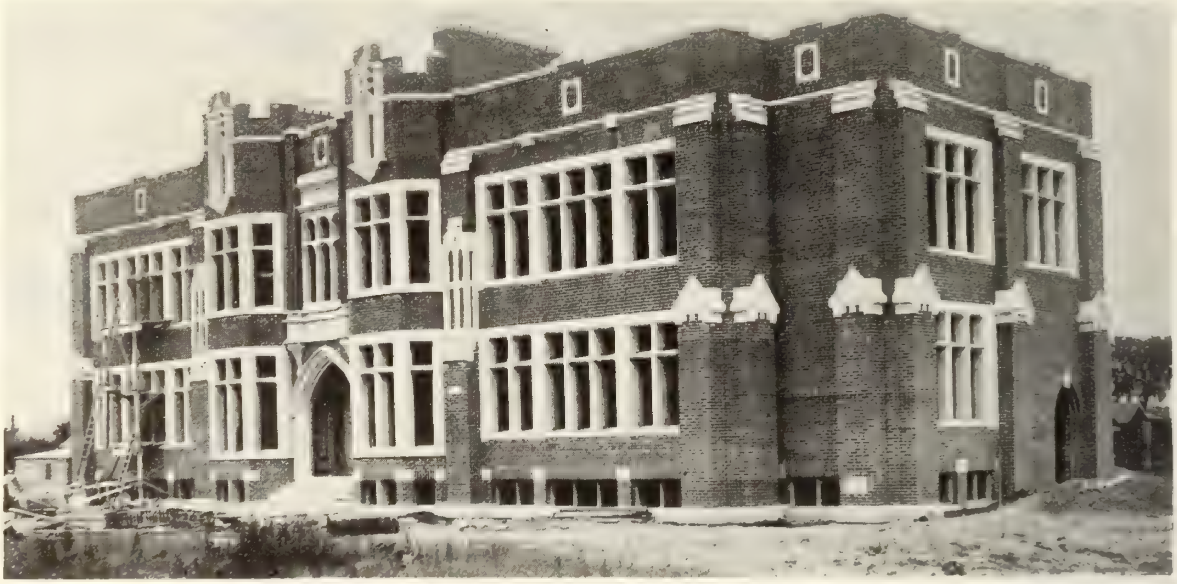

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Vol. 27 **October 29, 1913** **No. 44**

Trade Prospects for 1914

We are again approaching that season of the year when it is the general custom to take stock of the last twelve months' business and make plans for the next season. For this reason, as well as for the fact that the past year has been attended with very unusual conditions, a few remarks on the trade outlook for the coming year will be opportune.

Whether or not the year 1914 will be an active period for us industrially, depends, in the main, on two factors: (1) the natural demand for manufactured products, and (2) our financial ability to purchase these products. Without question there is only one answer to the first. Canada's capacity for almost unlimited development is established beyond the shadow of a doubt, so that our manufacturers may be assured of an ever increasing demand for practically every class of manufactured article. It remains then to discuss only the ability of Canadians as individuals, municipalities or private companies to provide the purchase price.

During the past summer, tight money has been a very real obstacle in the way of certain lines of activity. This condition was brought about partly by the unusual requirements of the European continent; also to a considerable extent by the amount of money that had become tied up in realty investments from one end of the Dominion to the other; but these conditions were intensified by the conservative, ultra-conservative we believe, attitude of our banks. Arguing that the signs foreshadowed a repetition of the crisis of 1907 and similar previous periods, and believing that prompt action would save the situation, they have followed the policy, apparently quite consistently, of lending no money which, as they thought, could by any possible chance be used to encourage the general extravagance to which Canadians were rapidly becoming habituated—the result largely of a number of years of unusual prosperity and plentiful money which had turned the heads of a large percentage of our citizens. This action of the banks has caused a great deal of discomfort to even their most deserving customers, and while it is generally conceded that caution, in reason, was the wisest course that could have been followed, it appears to us that the banks, by taking the extreme course, have unnecessarily curtailed the circulation of money and have done much towards producing the very condition—a trade reaction—they sought to prevent. Just how far their course was justified is difficult to determine, and it has undoubtedly placed the banks in a sound position so that at no time have they had to refuse assistance for developments which, in their own judgment, they have considered necessary. As a result the larger industrial life of the country has not suffered seriously, nor is there any sign of it in the future, for want of sufficient capital. Certain industrials report the biggest year's business in their history.

As already indicated, the extent of the demands to be made on our factories during the next twelve months will depend on the amount of money in the hands of (1) the individuals; (2) municipalities, and (3) private corporations. Our recent bountiful harvest has been an all important circumstance which will mean that the general public is pretty well supplied with ready money. The farmer only knows through the newspapers that money is scarce. As a result, the small retailer of general supplies such as hardware, boots and shoes, etc., except in the larger centres, will probably not experience any diminution in trade; this means continued prosperity for the wholesale dealer and manufacturer. In the building industry is it not a fact that practically every city and town in Canada is under-supplied with both public and residence buildings; and the population still continues to increase at a rapid rate. While building permits issued during the last month or two indicate a slackening in this line of trade, this, we think, is explained, in large measure, by the very general feeling that both workmen and supplies will be obtainable at lower rates; also, due to tight money, a certain amount of sacrifices have been thrown on the market. We see no sign of a diminished demand, however, and this slight reaction will just mean an increased activity in building trades of all kinds as soon as the money situation has readjusted itself. With an already inadequate supply of buildings, an ever increasing population, and a fair distribution of money among the middle classes, the demand for all kinds of building materials seems assured.

With the larger municipalities and private corporations the outlook may not be so entirely optimistic. These have found it necessary, often, to go outside of Canada for their suuply of money, which has not been so readily forthcoming during the last few months, on account of similar demands from other sources. Canada's natural resources, however, constitute a splendid security which stands behind all her industrial undertakings and we are confident that, even in a world competition, she can obtain the necessary supply of capital; perhaps, just at this time, at a little higher rate, but not so high that the resultant developments will not amply justify the increased cost.

And after all has been said on both sides Canada's immediate and ultimate prosperity is inseparably tied up with the prosperity of her great rural population, which at the present moment is possibly not equalled in any other country in the world. Our crops, just harvested, will put into the pockets of the farmers during the next few months in the neighborhood of $300,000,000. This will soon find its way through the usual channels to the manufacturers. To this sum might be added dividends from investments which are being distributed to the general public at the annual rate of something over $150,000,000. This will also indirectly reach the manufacturer. The extent to which the natural frugality of the average citizen will assist in the readjustment of conditions is of course difficult to determine in dollars and cents, but there is no doubt that at a time like the present a general policy of curtailment is being followed by most of us and these accumulations will be ready for circulation as soon as the general public judges the opportune moment has arrived.

Summing up the situation, while we anticipate that difficulties will continue to be encountered for some time in obtaining large sums of money abroad, this condition we believe will be more than offset by favorable local factors of which we may mention: (1) the unsatisfied demand for every kind of manufactured product; (2) unexampled prosperity of our great rural population; (3) good security and high returns of Canadian investments which means ability to borrow abroad; (4) present low conditions of stock supply; it is generally conceded that the retailer is running very low following the general policy of caution.

Engineering in the West

ONE of the prominent features of western progress, is the great amount of engineering work that is being carried out. The rapid growth of the population, the development of the cities, and the expansion of agricultural and other industries, create a demand for new railways, improved roads, waterworks, sewerage, sewage disposal works, steel and reinforced concrete structures, bridges, gas works, electrical works, agricultural implements, iron foundries, brick works, coal mining, mills, quarrying, refuse incinerators, laundries, heating, ventilating and many other branches of engineering works, all of which give employment to engineers.

While this is true, there is also enormous room for further engineering enterprises. The utilization of local materials await fuller development. Practically all sewer pipes, terra cotta, and other clay products are imported, yet there is an abundant supply of clay, which only needs thorough scientific investigation to find a process by which it can be manufactured into pipes, tiles, bricks, etc.

Winter employment is a problem which requires greater attention, for if all workmen could be employed twelve months in the year, instead of only a few months each year, it would produce an important economic result. At present there is a rush of outdoor work in summer and frequent dislocations due to strikes, whilst in winter there is much less doing and consequently no strikes. The moral effect of more continual work would certainly be great.

Mixed farming would be the means of introducing new industries, for instance, stockyards, abattoirs, packing houses, creameries, cheese factories, tanneries, and various leather and other works would be established.

Electro-chemical works would convert the nitrogen of the air into fertilising or other commercial commodities. A process can, doubtless, be found which will convert lignite into transportable fuel and to extract the tar and oils. Sand and gravel could be made into concrete slabs in winter to be laid in summer. Flax seed could be crushed to extract the oil and a number of new industries would follow. While it is desirable to introduce new industries and to expand those already established, it will be well to bear in mind that new industries can also be created which will be indigenous to the country, and of great advantage to the community. The foregoing constitutes only an indication of few of the possibilities which await the efforts of engineers and chemists to be developed into actual realities.

Suggested Re-Organization of the Canadian Society

THOSE who attended the last annual convention of the Canadian Society of Civil Engineers will recall that one of the live incidents in connection with the meeting was the strong plea made by the British Columbia members for the institution of a provincial section of the society in British Columbia. No active measures were taken, however, and it is fair to assume that the matter was left for the careful consideration of the society at a later date —whatever and whenever that means.

For some time after the meeting, the subject was kept alive by an interesting discussion in this journal, to which many prominent members contributed, but although numerous valuable suggestions were brought forward, there were no apparent results, except perhaps the crystallisation of engineering opinion. In our issue of February 5th, 1913, and in subsequent numbers of this journal, we expressed agreement with the views of certain members of the society in British Columbia. We gave it as our opinion that the representatives from the coast province had made a clear case in favor of a strong local authority. We made bold to criticise the inactivity of the parent society and to commend the characteristically western enterprise of the Vancouver and other supporters of the provincial section idea.

Now we find the old topic brought up once more —this time, officially, by the Vancouver branch, supported by members of the Victoria branch. A resolution in favor of instituting a provincial section for British Columbia has been forwarded to the society and will have to come up for consideration at the annual meeting in January. The proposition was dealt with very ably by Mr. Conway in an address reported on the following page.

One cannot remain altogether unconvinced after reading some of Mr. Conway's observations. The history of engineering in British Columbia is not of the kind to provide great encouragement for the profession in that province and it would seem that some active policy were not only advisable, but vital. At the Montreal convention last January, the society was reminded of how an outside engineer, having an outside staff, was engaged in connection with the New Westminster harbor works, an undertaking entailing the expenditure of over four million dollars. This is only one example of many that could be brought in evidence of the poor status of the profession in British Columbia. Mr. Conway hopes to see the Canadian Society in the same plane as the Institution of Civil Engineers of Great Britain. If this ever comes about, it will be through working for just such high ideals as some of the western members have formed.

One might refer to definite aims rather than to ideals after reading those sections of Mr. Conway's address dealing with educational facilities and also with the opportunities for harbor development in British Columbia.

Here, perhaps, is the distinction. The parent society has the ideal—a hazy, poetic, romantic vision of a society of highly-trained engineers working always along purely professional lines for the advancement of engineering knowledge. This is very fine, but there is something associated more intimately with the bread-and-butter side of the engineer's life, and it is for a younger and more aggressive generation to arise and take up this work for that section of the engineering profession in Canada that prefers things tangible to things visionary. Whether the impetus come from British Columbia, from the prairies, or from the East, affects this view of matters very little.

As for the immediate aims of the Vancouver and Victoria Branches, we believe that they are justified, and we look forward to their consummation. It remains for the big men of the parent society to decide whether they are big enough to direct the destinies of a bigger organization.

The British Columbia Engineer and His Problems

An impressive address bearing upon engineering conditions in British Columbia and the peculiar problems which the profession in that province have to solve, was delivered by Mr. G. R. G. Conway, Chairman of the Vancouver Branch of the Canadian Society of Civil Engineers, in his opening address of the winter session on October 13th. Copious extracts from Mr. Conway's address are given below, while editorial comment is made on the preceding page.

Plea for a B. C. Section of the Society

The British Columbia Engineer has been, and is still, daily confronted with many great and serious problems. During recent years the enormous development of the natural resources of the province, the building of railroads, the construction of water power plants, irrigation works and manufacturing industries, have attracted to the west engineers of no mean ability who have directed and carried out works that rank with any that have been constructed in other parts of the Empire—works that bear witness to indomitable resources and the inventive genius and ability to control and harness natural forces with economy for the benefit of the community. In the great work that is now going on around us, the Canadian Society can with pride claim no small measure of credit, for, with few exceptions, the real live men who are responsible for the great engineering works are members of the Society.

It is because of their real, as well as numerical, strength, that the British Columbia members feel that a closer union between themselves is vital and necessary. It is true that we have important branches in Vancouver and Victoria, but we feel that our parent society with its headquarters at Montreal is somewhat out of touch, both geographically and in spirit, with western ambitions. The local branch in Vancouver has been in existence now for about four years, but that is a long time as we measure our growth here. The Victoria branch is even more youthful, but we feel that we must arouse ourselves into vigorous activity so that our honoured and venerable parent will appreciate the fact that her lusty western branches have arrived at years of discretion and are able to judge what is good for their own progress, and how that progress can assist the national society. In anything we suggest, we wish to be quite emphatic that nothing shall be done that will divorce use from or alienate the sympathies of the parent society. The wish of all of us is to broaden and increase the influence of the Canadian Society of Civil Engineers, so as to make it a truly representative national society, wielding a more powerful influence over the whole Dominion than it does at present. We do not want it to become—as Western members are inclined to think sometimes it may become—a purely local society for members in the neighborhood of Montreal and Ottawa, living under the influence and fostering care of McGill University, but a society that shall also adequately represent the engineering activities in all the great provinces. At the present time in British Columbia we have about 240 members who gain practically nothing from the parent society and who feel that any benefit that comes to them from membership is entirely dependent upon local efforts.

As you are aware, we have been discussing for some time past the formation of a British Columbia Section of the members, so that our influence in the province will be recognized more fully and in order to obtain for ourselves a greater share in the government of the society—so far as our provincial interests are affected—than is possible under present conditions. We have taken up these matters with the Council of the Society and are now proposing to forward for consideration at the annual meeting in January at Montreal, a definite proposal, which it is to be hoped, will be cordially endorsed by all the members in British Columbia.

Briefly, the proposal is that we shall form a Provincial Division of the Society and still retain the local branches, but who will co-operate in all matters that are vitally important to the members in British Columbia. This co-operation, we believe, is of great importance when approaching the Provincial Government on public matters, so that in any petitions it will be felt that we are a united body of trained specialists, who, in an advisory capacity, might be of great assistance in the many problems that arise where engineering counsel is necessary. Furthermore, we wish to impress upon the government that the employment of our own countrymen in carrying out the great public works of the province is essential, and we wish it to be recognized that from the ranks of the Canadian Society the best engineering talent in the Dominion of Canada can be found. If the British Columbia Division is formed, we shall become so influential that no government can afford to dismiss our proposals or suggestions lightly. It is our ambition to place the Canadian Society upon the same influential plane as the Institution of Civil Engineers of Great Britain and the American Society of Civil Engineers, whose recommendations to their governments are not only welcomed but eagerly sought after.

Educational Facilities

There is another matter in which we, as members of the Society, are profoundly interested, and that is the new University of British Columbia. We are proud of the spirit that has been shown by our provincial legislature in recognising that British Columbia needs a university that will adequately cope with the higher educational problems of a great province, and where the youth of British Columbia, scattered as they are over 400,000 square miles of territory, can be trained for the business of life—a university where the intellectual resources of our people can be cultivated to the highest degree. Such a university will help to make many of the western problems easier to solve. We have great natural resources, but these are of little importance unless wisely developed by trained minds—and the official recognition of this fact is a significant and important one.

As an engineering society we are vitally interested in the manner in which the great problem of the education of the engineer is to be approached. We recognize that in his education not only must the scientific and practical side of the engineer's life be cultivated, but the imaginative and emotional side also. The professors and lecturers in engineering must be large-hearted and versatile men, not only skilled in their special science but also in touch with the practical world of engineering practice and business. In the University, we feel that in addition to the essential departments of civil, electrical, mining and mechanical engineering, special attention should also be paid to the problems of economic geology and mineralogy, and there should be a department for the special study of irrigation and the conservation of water. The future of the great central portion of British Columbia is dependent upon a scientific understanding of the proper storage and disposal of water upon the land.

A forestry department, needless to say, must not be overlooked, when we realize how much must be done to prevent waste, and how great the conservation problem in the lumber industry will become.

As a great seaport, encouragement should be given to the study of naval architecture, and in view of the need for the establishment of new industries, many technical classes should be established, such as those in the Glasgow and West of Scotland Technical College, and in similar institutions.

All these things we hope for and must constantly urge upon the authorities, and I believe the Council of the University already appreciate the claims of engineering to a prominent place in the University's calendar. If that be so, we shall have a real university that will be the intellectual centre of the province, beneath whose notice nothing that wisely contributes to the needs of our time will be neglected.

We are fortunate in having on our programme for the present session the name of the President of the University, Dr. Wesbrock, and I think that it is a happy augury of the future that he is to talk to us at an early date on "Pioneers and Engineers."

Looking backward and looking forward, we are proud of the great engineering works in the province. Think of the problems now involved in the construction of three thousand miles of railway, at a cost of $175,000,000; of the engineering work of the municipalities, of the development of our vast water-power resources—resources which I think in British Columbia might conservatively be placed at 3,000,000 horse-power; of the problems met in mining engineering and the lumber industry. With all this, much remains to be done, and in the department of harbour engineering there is unlimited opportunities for the engineer on our coast.

Let us pause for a minute to think of the local situation. I am aware of industries that are being crippled by the lack of proper dock accommodation in Vancouver. As we think of the blasting away, a few days ago, of the great Gamboa Dyke that will soon permit the waters of the Atlantic and Pacific Oceans to meet at Panama for the purpose of changing the great shipping routes of the world, we cannot help wondering how prepared or how unprepared Vancouver will be in 1915 when Europe wishes to send her great steamers to our port. We are spending $175,000,000 on great railroads in this province to link up the east and the west of our Dominion, but are we doing enough to assist in making these great railroads of material benefit to use when they are completed? In Burrard Inlet we have, I believe, with the exception of San Francisco, the finest harbour on the Pacific Coast—a harbour that needs no great expenditures to protect it from the fury of storms, as many famous harbours have done, but one where the requirements are chiefly wharves and docks that will be absolutely necessary if we are to maintain a great trade with Europe—or, perhaps, even what is more important, a great trade with the awakening Orient.

The engineer can transform Burrard Inlet into one of the finest harbours in the world. Although some activity has already been shown by our parliamentary representatives in arousing interest in these enterprises, we are delaying too long in starting the projects.

The same problem is confronting New Westminster, and with Government aid Victoria's harbour is being improved; but Vancouver is destined to be the greatest port in Canada, and it behoves us all to realise the priceless natural heritage we have and do our best to stimulate its development without further delay, along rational and progressive courses.

As engineers engaged in the design and construction of public and private engineering works, we have a great responsibility. Remember that we must "hitch our wagon to a star" and keep before us the highest ideals of our profession. In carrying out engineering works, we must prevent extravagance, remembering that the funds that have to be raised in England and elsewhere for the expansion of this province must be expended wisely so that the confidence of the investing public can be maintained and fresh inducements given for gaining their further support. In carrying out great public works, we need engineers who fully realise their responsibilities. The Canadian Society will become a strong and potent influence, so that engineers and engineering are not made to suffer by the caprice of minor politicians.

Broadly speaking, the engineering work in British Columbia has been well carried out. There are instances of extravagance, but, in most cases, the engineer has not been responsible, and, as I have already said, we can point with pride to what has been accomplished in the past, what is being done at the present and what is being planned for the future.

PROPOSED CHANGE IN THE BY-LAW OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS

At the conclusion of Mr. Conway's address, and after some discussion, the following resolution was submitted to the meeting, which was attended by a strong delegation from the Victoria branch. It was resolved unanimously to forward the resolution to Montreal for the consideration of the parent society.

A new by-law, to be numbered 56, and to read as follows: —

A Provincial Division of the Society may be established under the authority of the Council at the request of the majority of the corporate members residing in the Province.

All members residing within such Province shall be members of the Provincial Division so formed.

The Officers of a Provincial Division shall be a Chairman, a Secretary-Treasurer, or a Secretary and a Treasurer, and a Committee of four or more members. The Committee shall be elected by a letter ballot of the corporate members residing in the Province. The Chairman and the Secretary-Treasurer, or the Secretary and the Treasurer, shall be elected by the Committee.

The Constitution and By-laws of all Povincial Divisions shall be subject to the approval of the Council of the Society. The Secretary of the Provincial Division shall transmit to the Council, copies of all minutes of meetings, and reports of all proceedings of the Division. The Secretary and the Treasurer shall present a yearly report to the Annual Meeting of the Society.

The Parent Society shall, in addition to the rebate to the branches, grant a further rebate to the Provincial Division of One ($1.00) Dollar per head for every corporate member in the Province, other than those connected with the Local Branches."

This by-law was forwarded to the Secretary of the Society. It was formally signed by the most prominent and representative engineers in the West, of whom many are among the oldest members of the Society, and also by the Chairmen of the Victoria and Vancouver Branches. The names of those signing were Messrs. H. J. Cambie, Thos. H. Tracey, T. H. White, A. E. Hill, F. L. Fellowes, F. C. Gamble, G. R. G. Conway, J. H. Kennedy, R. F. Leslie, G. H. Webster, H. M. Burwell, J. F. Garden, H. B. Smith, H. Carry and J. R. Grant.

James Spelman on Grain Elevator Construction

MEMBERS of the Canadian Society of Civil Engineers, Montreal, opened their winter session on October 16th, when Mr. James Spelman, vice-president of the John S. Metcalf Company, Limited, gave an address on grain elevator construction. This is the first occasion on which the members have met, for lecture purposes, in their new premises, Mansfield street. The hall is a great improvement on the old one, being better lighted and more adapted for its purpose.

Mr. Spelman, who brightened his address with many humorous asides, gave a brief history of grain elevators, pointing out that the class of elevator designed depended upon the location and upon the nature of the business for which it was required. He described in detail one of the structures on Georgian Bay, and also spoke of the problems which had to be dealt with. Elevators were, he said, at one time constructed entirely of wood, by mechanics, who had not scientific knowledge of pressures, etc. The difficulties were overcome by the natural ingenuity of the mechanic, who sometimes showed more ingenuity than the college bred man. About 1895 there were demands for fireproof elevators, owing to the increased cost of lumber and high insurance rates, and steel, tile, and finally concrete were employed in building elevators. At that time, too, great attention was given to the question of pressure, and Mr. Spelman detailed experiments made to ascertain the pressure of the grain in the elevators. He also referred to the methods of erecting concrete elevators, the rate of construction of bins—averaging 6 ft. per day in summer—and described the mechanical appliances for delivering and discharging the grain. The address was illustrated by a large number of views thrown on to a screen.

In the discussion which followed, Mr. J. A. Jamieson spoke of the importance of economical handling, which was the great problem in this class of engineering. Even with the latest appliances the handling of grain in elevators, and the loading and unloading from cars and vessels, were subject to delays. Elevators in some cases had been put up more with a view to storage capacity than economic handling of grain per bushel, and he thought the problem of the future would be to secure expeditious and more economic handling.

Mr. F. W. Cowie, chief engineer of the Montreal Harbor Commission, thought the construction of elevators would for a long time remain a field for specialists, on account of the special design and intricacies of the machinery required. It was pointed out that the Montreal Harbor Commissioners' elevators had tremendously increased the grain capacity of the port. In the past six years elevators had been constructed there at a capital cost of four and a half million dollars, handling at the rate of forty-five million bushels a year, and earning a revenue of $250,000, while the grain was handled in them at a rate of 7-10 of a cent a bushel.

Foundation Difficulties at Regina

Considerable difficulty has been experienced by the engineers engaged upon the construction of the new Grand Trunk Pacific Railway hotel at Regina in securing a good foundation for the edifice. Owing to the yielding nature of the ground, and to the fact that rock bottom cannot be found, piles were useless for the purposes of securing sound footings. In order to overcome the difficulty presented by this combination of circumstances, it has been necessary to construct a mattress of reinforced concrete over the bottom of the entire excavation upon which to erect the structure. This mattress, by distributing the load of the building over a large area, will prevent subsidence, and should prove satisfactory so long as the reinforcements are placed judiciously and in a manner which will avoid rupture. The mattress has a thickness of five feet, and will add materially to the cost.

LETTERS

Analyses of Sewage at the Springfield Disposal Plant*

New York, October 23, 1913

Editor Contract Record:

Enclosed please find copy of a report giving the results of analyses made of the raw and treated sewage at the Springfield, Mo., sewage disposal plant. At the time the samples were taken, the plant was operating at an average daily rate of 3,000,000 gallons. Sample No. 278 is the effluent from the percolating filters after two hours' settling in the final settling basin.

Yours very truly,
Alexander Potter.

Laboratory No. 275 is crude sewage; No. 276 is effluent from settling tanks; No. 277 is effluent from the percolating filters; and No. 278 is the effluent from percolating filters after 2 hours standing.

	No. 275	No. 276	No. 277	No. 278
Nitrogen as				
Organic	107.0	68.4	27.2	15.6
Free Ammonia .	16.5	14.0	3.7	2.9
Nitrites	None	None	0.288	0.864
Nitrates	None	None	None	None
Oxygen consumed ..	59.3	23.8	10.0	14.5
Suspended Matter				
Total	135.0	41.2	9.2	8.8
Volatile	115.0	28.0	6.4	6.0
Fixed	20.0	13.2	2.8	2.8
Dissolved Oxygen ..	None	Slight trace	Trace	Trace
Temperature	69*F	68*F	67*F	
Total number of bacteria per cc.	9500000	6450000	1110000	360000
B. Coli Communis in 0.0001 cc. approximate % positive samples .	100%	95%	90%	65%

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* Described Contract Record, October 22, 1913.

Front elevation and main entrance of new factory building for Messrs. Rolph & Clark, Limited.

The Construction of a Modern Printing and Lithographing Factory at Toronto

By A. E. Wynn, B.Sc.

THE largest and most up-to-date lithographing and printing factory in Canada has just been completed for Rolph and Clark, Limited, Toronto. A description of this building should be interesting to readers of the Contract Record as it is the only one of its kind in Canada, used for lithographing purposes.

As, in this business, good light is of extreme importance, this was given the first consideration. Accordingly, a design was adopted for the building, having a large proportion of window surface, and a sawtooth roof with deep skylights on the north sides. Other points of importance were that the building must be fireproof, all machinery must be on one floor, and every department visible from the overseer's office. The last two conditions decided that it must be a one-storey building.

The factory has a frontage of 300 feet on Carlaw Avenue, with a depth of 250 feet. A 20 ft. lane is provided for on the south and east sides, while on the east is a G. T. R. spur. It is 41 ft. high to top of roof, with a gallery 45 ft. wide running all round it, 12 ft. 6 in. above the main floor. Under the front part of the building is a basement, 43 ft. wide by 300 ft. long, 9 ft. deep.

Foundations

Excavation of the basement was begun in October of last year. A steam clam was used to take out the 5,000 cu. yds. of material, which was used to fill in the adjoining lot. The land falls about 5 ft. south to north. Good hard clay was met with at a depth of 4 ft. to 6 ft., so it was not necessary to dig deep to obtain good foundations.

After the whole site had been cleared of soil and vegetation, a network of 3 in. of weeping tile was laid, running in diagonal branches from a 4 in. tile drain, which emptied into a 6 in. drain in the basement. Weepers were also laid along the footings of the walls. All the drainage was collected in a sump at the south end of the basement and was pumped out by a pulsometer, which was kept working every day until the building was finished, considerable surface water always flowing in the drain.

The walls, up to 2 ft. 6 in. above grade, are 18 in. concrete, carried on concrete footings 2 ft. 6 in. wide by 12 in. deep, a bearing pressure of 2 tons per sq. ft. being allowed on the foundations. No waterproofing material was used, but the outside of the walls was given two coatings of tar. A 6 in. reinforced concrete wall was built up to grade, 3 ft. away from the front wall, to form an area way. The piers under the floor are 15 ft. c. to c., from 4 ft. to 5 ft. square at bottom and 15 in. to 21 in. square at the top, having footings 12 in. deep. On these are concrete columns, 15 in. to 21 in. square and 1 ft. to 6 ft. high, varying with depth of foundation. These carry the floor beams.

Brick piers, 18 in. and 22 in. square, set in cement mortar, carry the beams over the basement. In all, over 1,350 cu. yds. of 1:2:4 concrete were used in the foundations and walls.

Brick Work

The brick work is of superior factory type. The walls consist of 3 ft. by 18 in. piers, with 4 ft. 6 in. by 6 ft. 6 in. window openings, the curtain walls being 13½ in. Red pressed brick was used on the outside and grey stock inside. The walls were finished off with tile coping.

The front wall is of best picked red brick, with stone sills and continuous bands of stone over the window frames. It is carried up 3 ft. higher than side walls, forming a parapet, and is finished with stone coping.

The principal feature of the front is the main entrance, the architectural style of this portion being Italian Renaissance, with fluted pilasters and Corinthian caps. The name of the firm appears on the frieze above. In all, including interior walls, over 600,000 brick were used. On the sides and back of the building the window heads are all reinforced concrete, poured in place.

Hope's steel window frames were used in all the

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*Superintendent for Messrs. Sproatt & Rolph, Architects, Toronto.

walls, glazed with rough rolled opaque glass—in all, 9,000 sq. ft.

Floors

All the floors and beams are reinforced concrete. The Kahn system of reinforcing was adopted. The main floor was designed to carry the heavy live load of 250 lbs. sq. ft. plus 20 lbs. for finish, and the gallery floor a live load of 125 lbs. sq. ft.

In designing the floors it was found more economical to decrease the thickness of slab and increase the number of beams, the design having to comply with the Toronto City by-laws, which call for 16,000 lbs. for steel in tension, 650 lbs. for concrete in compression and 100 lbs. in shear for steel and concrete combined.

The girders of the main floor run north and south, have a span of 15 ft. and are 12 in. by 28 in. reinforced with two ¾ in. by 2 in. Kahn standard bars, one ¾ in. by 2 in. Kahn centre shear bar, two ⅝ in. bent rib bars and one 1⅛ in. straight bar. The intermediate beams are 5 ft. c. to c., 8 in. by 18 in., with two ¾ in. by 2 in. standard bars and two ½ in. bent rib bars.

The gallery beams are similarly spaced. The girders are 10 in. by 24 in. and the beams 8 in. by 16 in. Where the girders are carried by the brick walls concrete padstones were put in. The main floor slab has an area of 73,000 sq. ft. and is 4 in. thick. The gallery floor slab is 40,000 sq. ft. and is 3½ in. thick. Both are reinforced with expanded metal and the concrete is mixed 1:2:4. Beams and slab were poured together, cut offs being down the centre of girders. The slabs were left rough.

The average day's pour was 80 cu. yds., the total amount of concrete in slabs and beams being 2,600 cu. yds. A hoisting tower was erected, but it was found more economical to use wheelbarrows, although this necessitated a long wheel.

As the greater part of the concreting was done in winter, the sand and stone were heated by steam pipes. Warm water was used for mixing, shavings being spread to a thickness of 2 in. over the slab. A special feature of the main floor is a pit, 75 ft. by 14 ft., dropped 15 in. This is carried independently of the floor by 14 in. brick walls and reinforced concrete beams 5 ft. apart. It is used to carry the heavy presses.

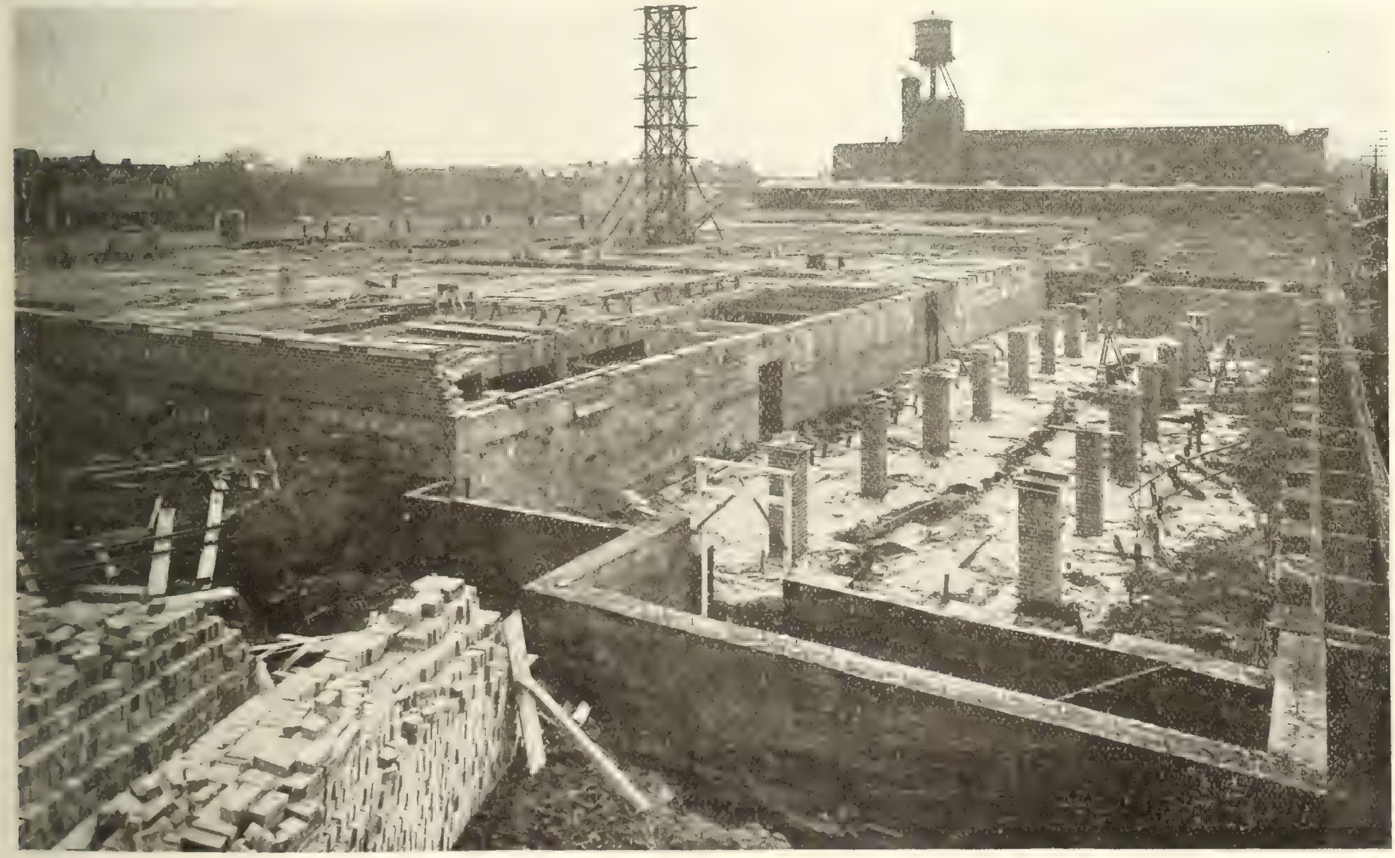
In considering the question of floor finish it was necessary to have a hard, durable, dustless floor. Specimen cement finishes were put down, the one adopted having a thickness of 2 in. and containing nothing but ¼ in. granite or traprock and cement in proportion 3:1, trowelled up perfectly smooth and covered with shavings kept wet for a week. Although this was put down two months after the rough slab a perfect bond was obtained. The gallery floor has a similar finish ½ in. thick, put on the day after the rough slab was poured.

To keep the basement floor dry, 2 in. concrete was laid on 5 in. cinders and covered with 3-ply ready roofing, mopped with tar. This continued over the footing and 1 ft. up the back of the wall, the top being turned into the wall; 3 in. of concrete was then laid and trowelled up smooth with a drier of traprock and cement 3:1.

The floors of the offices, lunch rooms and lavatories are laid with Sanorto, which gives a hard, durable, dustless and noiseless floor.

Steel Work

The roof is carried on 215 steel columns, 30 ft. c. to c. north and south and 15 ft. c. to c. east and west. Those in the centre of the building are built up of two



Basement and form work for main floor. Feb., 1913.

6 in. channels, 23 ft. high, laced back to back. The others carry the gallery as well and are 8 in. by 8 in. H section up to floor and 5 in. by 5 in. H section above, with brackets to carry the beams. Intermediate 6 in. by 6 in. H columns help to support the gallery.

The roof trusses are sawtooth shape, 30 ft. span and 15 ft. high, built up of light angles.

Four rows of 8 in. channel purlins are bolted on the south side of the trusses. The last two rows of trusses on the east and west sides of the building are wind-braced with 2 in. by 2 in. angles.

Roof

A flat roof 14 ft. wide, falling ½ in. to the foot, extends all around the building, and is made of 3 in. by 6 in. t. and g. spruce, spiked to a plate on the wall and resting on 8 in. I-beams carried by the columns.

The south sides and ends of the trusses were covered with 3 in. by 6 in. t. and g. spruce, spiked to plates bolted to the purlins. The north sides were similarly covered for 4 ft. 6 in. up, and finished off with a 3 in. by 6 in. sill to carry the glazing bars. Hope's patent double glazing, in all about 40,000 sq. ft., was used throughout in the skylights. The inside glazing was rough-rolled wired glass carried by galvanized iron bars 2 ft. apart and 9 ft. long. The outside rough-rolled glass was carried by lead bars 2 ft. apart and 9 ft. 6 in. long.

Both the sills and the cornices were flashed with lead, and lead condensation tubes were inserted in the sills between the glazing. The amount of lead used was enormous, there being about 16,000 lbs. for flashing purposes alone. The lineal feet of bar used were 19,100.

The whole roof was waterproofed with Johns-Manville roofing, the sawtooths being covered with 4-ply asbestos roofing. The valleys and flat roof were built up with 2-ply asbestos roofing and 2-ply felt paper, mopped with asphaltic paint, and the gable ends with 2-ply asbestos siding. Gutters were put in the valleys and along the flat roof to drain the water to copper hoppers fitted into the conductor pipes, one hopper being placed at the end of every truss on the flat roof and three in each valley. The pipes are taken down the columns to the main drain under the floor.

Interior Work

The different departments are divided off by wood and glass partitions. An innovation in extensive partition work was the use of Hope's steel frames glazed with clear glass, set on 3 in. spruce partitions 4 ft. 6 in. high. The whole of the gallery is also enclosed with this kind of partition. This enables the overseer to see from his office every employee in the building, and it also has the advantage of cutting off no light, as would have been the case if solid partitions had been used.

An interesting feature is the bronzing room, 75 ft. by 30 ft. This had to have plenty of light and be roofed over so that the fumes would not escape into the building. The roof is a hipped skylight carried by four light steel trusses bolted to the latticed columns. The whole of it is lead-glazed with Hope's patent glazing, the bars being carried by purlins and notched to a 3 in. angle bolted to the top of the side frames.

The offices occupy the front gallery. The partitions and ceilings are metal lath and plaster and all the woodwork is oak. The offices are connected with the main floor by a wide iron staircase. Five large vaults were built of brick—two in the basement, two on the main floor and one on the gallery. The overseer's office is situated under the gallery in front of the entrance hall. It is 24 ft. square and has a hardwood floor carried by joists, 3 ft. above the main floor, so that from here the whole of the interior of the building can be seen.

The basement is entered from the outside by a flight of concrete steps and is partitioned off into four parts, staircases connecting them with the main floor. As its floor is below the level of the street sewer, it was necessary to put in a concrete tank, taking the place of the sump used during construction. This is

General view of building during construction, in particular showing the gallery. June 1913.

On the left, under the gallery in front of the main entrance, the Overseer's Office, from which all the various departments can be seen; on the right, the Bronzing Room (without the roof).

fitted with two electrically-driven pumps controlled automatically by floats, with a hand pump in reserve. The tank collects any seepage from under the floors and any drainage from the boiler room.

The wide central doorway of the main entrance gives access to an arcade, leading to a spacious hall on the main floor connected with the offices above by means of a fine oak staircase. The arcade has a groined ceiling and the entrance hall is covered with a large skylight. The floors of both are red terrazzo marble. The woodwork of the roof and the concrete ceilings are kalsomined, increasing by reflection the light in the building. The partitions are painted green and the steelwork grey.

Two electrically-driven hoists, to carry 3,000 lbs. each, are installed.

The boiler room is situated in the south-east corner of the building and is 45 ft. by 45 ft. by 21 ft. 6 in. high, its floor being 9 ft. below the main floor. The floor is 6 in. concrete set on 5 in. cinders. Concrete foundations were put in for boilers, fan and pumps.

Above the pumps is a mezzanine floor carried by reinforced concrete beams and columns. The boiler room is connected by a tunnel at same floor level with the coal bunker, both being built of reinforced concrete. The tunnel is 7 ft. wide, 6 ft. high, and 20 ft. long. The walls are 12 in. concrete with ½ in. vertical rods 12 in. c. to c. The roof is an 8 in. slab, reinforced with expanded metal, and forms the lane round the corner of the building. The coal bunker is 30 ft. long, 12 ft. 6 in. wide, and 10 ft. 6 in. high, having a capacity for 100 tons of coal. Its walls are 12 in. concrete. The sloping roof is a 6 in. slab carried by a reinforced concrete beam on two 8 in. H columns, and is provided with three large iron doors and three windows. Two pockets are built out from the bunker under the siding,

View of Press Room.

enabling drop bottom cars to dump right into them. The track is carried over the pockets by two 18 in. I-beams, built into the walls.

Heating and Ventilation

The system used consists of direct radiation throughout the building and forced ventilation in the central portion and in part of the offices. The boiler equipment consists of two horizontal return tubular boilers, each having 1,800 sq. ft. of heating surface and designed to operate under a pressure of 125 lbs. per sq. in. These boilers are set in battery and are equipped with two Fulton smokeless mechanical stokers. Draught is furnished by a radial brick stack, 50 in. in diameter and 125 ft. high, built on a massive concrete foundation. The boilers are equipped with high and low water alarms. A uniform pressure will be maintained by an automatic damper regulator.

The auxiliary equipment consists of two Dean of Holyoke Vacuum Pumps, two Boiler Feed pumps, and Keiley Pump Governors. All radiation is equipped with Dunham Vacuum Traps.

The building is heated by about 20,000 sq. ft. of cast radiation and wall coils distributed around all of the outside walls of the building and placed under the skylights in the roof. The steam is distributed to the heating coils at from 0 to 5 lbs. pressure through mains below the floor, and the condensation is drawn through the return-line traps and a system of return mains by the vacuum pumps back to the boiler room. The vacuum pumps discharge into a receiving tank, from which the water of condensation is returned to the boilers by the boiler feed pumps.

The ventilating equipment consists of a No. 11 Sirocco Fan, of the latest type, belted to a 20 h.p. electric motor. This motor is controlled by a speed regulator and the apparatus is designed to supply from 30,000 to 50,000 cu. ft. of air per min. The air passes first through a tempering coil, consisting of 1,296 sq. ft. vento cast iron radiation, then through an Acme air washer and through a re-heating coil. The temperature of the air entering the washer will be automatically controlled during the winter season by Powers Thermostats, controlling the diaphragm steam valves on the tempering coils, and the temperature of the air leaving the re-heating coils will be controlled in the same manner. The thermostat controlling the tempering coils is located in the temperate air chamber, while the one controlling the re-heating coils was placed in the main discharge duct from the fan. This system will give a constant temperature and percentage of humidity to the air supplied to the building, which is very essential in a printing factory.

Finishing Room, showing roof construction and glass partitions.

Transfer Room, under the north gallery. Separate wash basins are provided for each hand press.

Power and Light

The machines in the building are driven by individual motors, amounting in all to 200 h.p. Current in the building is 550 volt 3-phase a.c. supplied by the Hydro-Electric and transformed by a 150 kw. motor-generator set. The lighting throughout is general illumination, with 150 single watt units, the spacing of tungsten lamps being 15 ft. c. to c. The lamps are fitted with Holophane steel, white enamelled reflectors. Independent of the motor-generator set are two 20 kw. transformers which will light the whole building. The dynamo room adjoins the boiler room and is laid out in such a manner that the plant can be doubled when necessary.

Sprinkling System

The building is equipped with International Sprinklers, with a city connection as a primary supply and a 50,000 gallon tank on a 75-ft. tower as a secondary supply. The 8-in. main that supplies the inside sprinklers continues round the south, north and west sides of the building, having a 2-way hydrant on the south and north sides and also having three 6 in. valves on the south side controlling the three separate units on that side of the building, the same applying to the north side. A concrete pit is provided for the city checks. The system installed for heating the tank on the tower consists of hot water circulation generated by a brass coil in a heater at the base of the riser.

General Plan

The general layout of the different departments is very simple. The central portion of the building is occupied by the press room, bronzing room and finishing room. The whole space under the north gallery is the transfer room and under the east gallery the stock room. The south side on both floors is occupied by Blackhall & Company, bookbinders.

Under the west gallery are situated the stonecutters and shipping room, two wide shipping doors in the south end giving access to the lane. The east gallery is given over to photography, finished stock and two lunch rooms, while the north is occupied by the artists' and proving room. The basement is divided into locker room, carpenter's shop and two storage rooms. The accompanying photographs give a good idea of the construction and general arrangement of the building.

The light, which was the chief point in the design, is all that could be desired, and the wide spaces and open construction give an imposing appearance to the interior.

The cost of the building works out at about eleven cents per cubic foot.

The architects were Messrs. Sproatt and Rolph, North Street, Toronto. The steam generating, heating and ventilation equipment was designed by Jas. McAlear, consulting engineer, 186 King Street West, Toronto.

The contractors for the different work were:—Excavation, brick work and concrete, Jennings & Ross Limited; steel work, McGregor & McIntyre, Limited; carpentry, A. Weller & Company; heating, plumbing, ventilation and sprinklers, W. J. McGuire, Limited; electrical installation, The O'Connor Electric Company; tunnel and coal bunker, Beck & Poole.

"Macadam"

By Major W. W. Crosby, M. Am. Soc., C. E.

GENERAL agreement as to the meaning of the word "macadam"—commonly used to refer to a type of road surfacing—would prove of great convenience. The writer does not know that there is at present much diversity of opinion as to what is covered by the term, but it has been stated to him that no general agreement has been reached on this point; that, in more or less numerous cases where experience had been limited to the use of construction of, say, a few kinds of broken stone, it seemed that little, if any, thought had been given to arriving at the limits of meaning of the term "macadam," it being granted that it applied to the work in hand, and that, accordingly, it might be wise to discuss the possibilities of its definition, and to suggest one such as a concrete starting-point for the discussion.

Any definition of "macadam," meaning a type of road surfacing, which limits the material to be used for its construction to crushed stone would, the writer thinks, be too narrow to be either correct or convenient. M'Adam, the engineer from whose name the term is derived, himself used no "crushed" stone, nor did he confine himself even to broken stone. He specifically refers, in his "Remarks on Road Making" (London, 1820), to the use of "gravel," "flint," "limestone," "whinstone," and "large pebbles mixed with sand," and says, "Excellent roads may be made with any of these materials." Then he later lays down certain principles for the use of "different materials," condensed extracts from which are quoted below in the order he gives them:—

> The size of the largest pieces of road metal should not "exceed an inch in any of its dimensions."
>
> The road (i.e., road crust) ought to be considered as an artificial flooring or roof over the foundation, which latter really carries the bonds, and to that end must be kept dry.
>
> The admixture of earthy or other fine material to broken stone is injurious, and a mechanical bond or interlocking of angular pieces of road metal is necessary. This should not be discouraged or interfered with by the presence of fine material.
>
> The road metal should preferably rest on a firm, but resilient, foundation, rather than on a hard, rigid one, such as ledge or rock paving.
>
> The thickness of the road metal should be no greater than necessary to preserve its integrity as a roof to keep the foundation dry.

Throughout the whole book may be found many references to the use of gravel by M'Adam, his criticisms of it as well as of various stones, and his suggestions for the use of each.

The point the writer wishes to make is that our term "macadam," considering its derivation, means the attainment of certain results based on the observance of definite principles rather than the use of particular materials or methods.

M'Adam had no steam rollers, no stone crushers, and the available materials for his road metal were limited to stone and gravel. Had good slag, for instance, been as available then as to-day, is it reasonable to suppose that so practical a man would have ignored its possibilities?

It seems to the writer that if we recognise the principles of M'Adam, referred to briefly above, and the wider resources for both materials and machinery now open, a proper definition of our term may be made as follows:—

> Macadam is a road crust composed of gravel, shells, slag, broken stone, or similar material, in which the largest particles do not exceed a certain maximum size (dependent in any case, to some extent, on the quality of the material used, but generally about 2 in. for the longest dimension), whose particles, having a size preventing their passing a ¾-in. ring, are compacted together so as to be interlocked and mechanically bound together to the utmost possible extent, and whose then remaining voids or interstices are filled, by the aid of water, with smaller particles and fine material from the same or similar sources. True macadam has no particles in the surface exposed to travel whose size is so great as to render them unstable under horse-drawn vehicular travel. Macadam built on top of an artificial foundation of paving is usually called "Telford," or "Telford Macadam."

In case a general acceptance of such a definition is had for "macadam," several related or subsidiary terms may be most conveniently used with an increase of clearness in their use. For instance, "shell road" may be used to designate a road surfaced with dredged shells, which are generally mixed with sand, silt, etc., while "shell macadam" would differentiate the surfacing built with clean shells, compacted and then filled (as to its voids) with only the necessary amount of sand or fine material. "Gravel road" would mean a road with a crust of unscreened or "bank" gravel, while "gravel macadam" would indicate the adherence to the principles of M'Adam. A "slag road" would be built of slag from the pile, unscreened. "Slag macadam" would indicate that breaking and screening the material had taken place in some way. Further along this line, the term "bituminous gravel (or shell or slag or broken stone) macadam" would then logically be a most convenient term for differentiating such a surfacing built by the penetration method from one built by the mixing method (a bituminous concrete).

It seems to the writer that it is up to highway engineers to adopt promptly such reasonable nomenclature in their work as will indicate by its saving of breath and ink their appreciation of the engineering demands, as well as those of the times, for efficiency.

The Leonard Locomotive Shops of the N. T. R. at Quebec

THE general layout of the repair shops of The National Transcontinental Railway at Quebec, P.Q., shows that not only has convenience of operation been the general principle governing the design, but future needs have also been provided for. Each shop is capable of extension without interfering with any other, and any department can be increased separately as occasion may require.

There are ten buildings in all, of various dimensions, each suitable for the special work to be done in them. These buildings consist of a locomotive, erecting, machine and boiler shop (under one roof), forge shop, freight car shop, power house, planing mill, dry kiln, lumber shed, forge stores and scrap bins, oil house, and office building for the executive staff. The total area covered is about five and one-half acres.

In the erecting shop there are eighteen pits, placed transversely, over which a 120-ton crane lifts locomotives into, and removes them from, their respective positions. A 20-ton crane, operates over the same area at a few feet lower level, and carries small material and make many light and rapid lifts.

The "transverse-pit layout" has the advantage of doing away with many side doors in the building for the "in-and-out" movement of locomotives. There are two doors, conveniently placed, through which engines and material enter and leave. This arrangement is economical in the matter of heating. It does away with the necessity of a transfer-table with all its inconvenience from snow and ice. The practically unbroken sidewall permits the use of jib cranes, one serving the fronts of two locomotives, being capable of lifting smoke stacks, main valves, smoke box doors and rings. The use of these very handy cranes would be most difficult if the wall of the shop had been cut up into a series of doors.

The large crane is carried on a series of built-up columns, so that the heavy load is central over the line of foundations. As one crane does the work of lifting and placing each locomotive, there is no chance of confusion such as might occur when two cranes are used, and where two men do the work. The single powerful crane has also the advantage over the usual twin crane arrangement in economy of first cost and maintenance.

All the overhead cranes are provided with effective safety appliances. One of the most important, prevents the load from being "overwound" by the lifting drum, either by accident or otherwise. It consists of a device which, when the maximum lift has been reached, automatically opens a switch on the hoisting circuit and so cuts off the current, thus suddenly removing the driving power. The cessation of the current immediately brings into powerful action a gravity operated brake, which is normally held out of service by the flow of current.

The direction in which the midway crane operates is a new departure in railway shop construction, which has been brought out by Mr. W. J. Press, Mechanical Engineer of The Commission, as it secures substantial advantages. The midway is laid out so as to be alongside of the shops, and not at the ends of the buildings as is frequently the case. The object of this arrangement is that when material is brought by the midway crane from the storehouse, forge shop or foundry to the machine, erecting or boiler shop, it is placed at the door nearest to the machine on which the material will be handled, or to the engine upon which it will be used. In this way the delivery of material is not concentrated at one spot at the extreme end of the building. It avoids distribution from a congested area, and it obviates the "long haul" through the shop. Material is laid down at a point as near as possible to its destination, and economy of time and labor, as well as facility in handling is thus secured.

The system of placing machines is such that the movement of material will be in one direction and the distance over which any locomotive "part" is carried, will not be unnecessarily lengthened by journeys forward from one machine and back to another. The continuous one-way movement of material saves time and labor and prevents interference.

The pits in the locomotive shops are supplied with steam, compressed air, hot and cold water. Depressions in the pit walls carry the pipes. By this arrangement the working space in the pits is not restricted and the pipes are not where they can be easily damaged by workmen dropping material on them.

The forge shop and boiler shop are placed as near as possible to the power house. This is important, for in the case of the forge shop, where hammers are operated by live steam, the short distance between boiler and hammer reduces condensation and delivers steam where it is required with small loss. A similar condition holds good in a sense, for the delivery of compressed air to the boiler shop machinery. The nearer the source of supply, the less the pipe friction involved and the smaller the losses due the forcing of air through the pipes.

Industrial tracks form convenient means of communication between the various shops. The buildings, cars, engines and supplies are protected by a water-system arranged to be readily put in use in case of fire. A further protection is afforded by reason of the use of concrete and steel in the various structures.

The shops are situated at Quebec and have been named after Major R. W. Leonard, Chairman of The National Transcontinental Railway Commission, under whose administration they were projected. The outlay has been carefully supervised so that excellent results will be attained and full value received for the money expended.

The whole plant has been laid out under the supervision of Mr. Gordon Grant, Chief Engineer. It is designed in such a way that the latest and most modern railway practice has been provided for.

The permanent and substantial character of the shops and the size of the whole plant will be of material advantage to the City of Quebec, by providing steady employment for a considerable number of men the year round. The contract for this important piece of work has been awarded to Mr. Joseph Gosselin, of Pt. Levis, Que.

The design and laying out of the plant, the relative size, arrangement and position of the buildings and the selection of the machinery and appliances has been entrusted to Mr. W. J. Press, Mechanical Engineer of The Commission, who has had charge of similar work at the Transcona Shops of the National Transcontinental Railway, near Winnipeg. The Transcona shops are now being operated. In general plan and in kind and quality of equipment they are of the most up-to-date type. The Transcona and the Leonard shop (when completed), will embody the latest design and the most modern practice, enabling them to be operated with a very high degree of efficiency. Altogether they will form a most valuable addition to the second of the great National "cross-continent" highways of Canada.

A Method of Contract Payments Based on Cost

By George I. Battelle

THE method of payment for heavy grading, as in railway work, where classification is the basis of settlement, has long been recognized as a makeshift and merely an attempt to base payment upon cost. This method results in more or less friction on almost all contracts, for there are generally some strata in a section of grading which, strictly speaking, may be classified under the specifications as belonging to a formation which calls for a less payment than the actual cost of doing the work, with the result that the contractor justly feels that equity has not been done him in the matter. This condition obtains more generally than its reverse, wherein the work is thrown into a higher classification than that warranted by its cost and the contractor takes an excessive profit.

In some cases recourse is had to force-account as a means to obviate the above difficulties, but this means is usually undertaken on minor work, or if of any size, with a contractor in whom the engineer has confidence. Force-account work, however, lends itself too readily to the undue benefit of the contractor and is not generally resorted to except on small work coming up in connection with a large contract. Force account work is merely cost plus a certain percentage. Another method of contracting is cost plus a fixed sum. This has not been used in railroad work, but is merely mentioned as an attempt to make the interests of the two parties to the contract as nearly identical as possible when referred to the cost standard.

General usage, therefore, prescribes for railroad work a contract which is based on cost under the guise of geological segeration with numerous tests and conditions to be met as the determining factors in doubtful cases of classification. The interval wherein honest differences may wander is generally of a larger scope than should be allowed, but under the classification idea can not be escaped from.

In what follows will be presented a method that is definitely based upon the actual cost of doing the work with nearly all incentive to pile up the cost removed. Under this method it is to the interest of the contractor to keep the cost as low as possible, for the lower his cost the greater his percentage of profit and at the same time the less is the total amount he is paid, thus reaching ends desired by both parties to the contract.

There are two variations in the use of the method, the first of which is primarily adapted to railway work, while the second is applicable in all branches of construction.

First Application

The first method would apply to a railway-grading contract of considerable extent wherein there are various graduations of strata differing in cost of handling. The procedure is as follows:

(1) Estimate as closely as possible the average unit cost of handling the major portion of the material.

(2) Establish an upper and a lower figure of which the average estimated in (1) is the mean with the upper figure twice as great as the lower; i.e., the upper figure is 4/3 the average in (1) and the lower figure 2/3 that average.

(3) For each section of the work the contractor is to get a unit price equal to the actual unit cost of that section plus one-half the difference between that cost and the upper figure established in (2); provided

(4) That the profits be not less than a certain minimum percentage or more than a certain maximum percentage established beforehand.

Should the bulk of the material be estimated to cost less than the remainder, the price schedule would be made an ascending one and a descending one if the reverse was the case. A table can then be easily prepared showing payments of increased percentage profits with decrease of cost below the estimated cost and decreased profits with increased cost.

For illustration, suppose the estimated cost of doing the bulk of the work under a certain grading contract to be 15 cents per cubic yard with the remainder of the work costing more. It is decided to allow a minimum profit of 10 per cent. and a maximum profit of 40 per cent. The price schedule under these conditions would be an ascending one of 10 cents, 20 cents, 40 cents, 80 cents, $1.60, and Table I. shows the unit price to be paid, with its attendant profit, when the actual cost has been determined.

Thus if the actual cost is the same as estimated, i.e., 15 cents, the pay price would be 17½ cents, showing a profit of 16 2/3 per cent.; but if the actual cost be cut down to 13 cents, the contractor would be paid 16½ cents, but his profit would be 27 per cent. On the other hand, if the actual cost amounted to 17 cents, the payment of 18.7 cents would give him only a 10 per cent. profit, which profit would continue until the actual cost ran up to 22½ cents, when his profit would be 40 per cent. on that cost.

Under this method all variations in cost of handling the same geological formation under the different conditions in which it might be found or of uncovering and moving a formation not contemplated under the classification of the contract, would automatically bring its own payment and obviate all discussion with the engineer as to the justness of a higher classification, and the skill used by the contractor in meeting the different conditions would determine the size of his profit.

The jumps in the table between 11 and 11½ cents, 22 and 23 cents, and 44 and 46 cents, correspond to, though they are not so great as, the variations of price under the usual classification contracts. It is near these points that the only incentive to increase cost exists and where the engineer in charge of the work would have to carefully watch the cost account of the contractor and be sure that he was neither lying down on him or trying to slip in outside costs in order to slightly raise his cost to that allowing the higher percentage. With a carefully estimated cost to which the price schedule is adjusted this contingency is quite remote.

In the measurement of volume to determine cost, individual cuts could be taken by themselves should the same method be taken of working them throughout, instead of measuring the volume of the different strata. Total yardage of a cut into total cost of removing it would point out its own payment and be an easier solution of the price to be paid than long bickering between engineer and contractor with a probable lawsuit showing on the horizon over difference in judgment as to the proper classification to be allowed for some certain yardage.

The variation of this cost method of payment referring to a single cost schedule where each figure therein is double its predecessor is applicable to any piece of large work composed of varying units, since in the railway grading for which it is written the cost of doing a unit portion widely varies by reason of uncontrollable conditions and may be anything between two extreme minimum and maximum prices.

Second Application

The price schedule under this variation is determined as under the first and is applicable to all forms of construction, as well as railway work.

Using railway work for an example, instead of asking for a bid for which the contractor is willing to remove certain kinds of material, a bid is sought upon the eliminated cost of doing the work by different methods, i.e., by scrapers, by wheelers, by steam shovel and wagon, by steam shovel and cars, or by whatever method the contractor is equipped for and the situation is favorable to. The difference between the two applications lies in the fact that in the first the bid is based upon a rather hazy estimate of the different priced yardages to be handled which is often very misleading. In the second case the method of handling a closely known yardage is the basis of the bid, with each party sharing in the decreased cost if the estimated cost is found to be too large.

Corresponding to the figure bid for each of the different methods proposed for handling, a table of payments could be made by referring the actual cost of any certain yardage to a figure one-third larger than the bid and dividing this difference between both parties to the contract up to the points where the minimum and maximum percentage were reached, beyond which points their respective percentages would obtain on the actual cost of doing the work. This may be illustrated in Table II.

The second variation is merely a special case of the first. In the first, one price schedule is used throughout for all methods and final costs and is obtained by doubling each preceding figure to obtain the succeeding one; in the second, a single short table is made for each figure bid and though the cost may increase it never jumps into the next higher table, for the one table always applies to the method of handling upon which it was based.

Though the illustrations of both variations of the method are made by reference to railway grading, the second way lends itself very readily to concrete, steel, or brick work, timber framing, roadwork, pile-driving and in fact to all construction where payment is made upon the number of units of various kinds incorporated in the work.

Under this method the one letting the contract would have to be supplied with, as well as check, all pay rolls, original bills of material, equipment rental, and stock rental, if not more, to the cost record on a contract as he now gives attention to the workmanship under it.

Among the advantages to be cited for this method of contracting may be mentioned:

The range of bidding on any one contract is larger than under the present, for in addition to the range of prices there is the variations in the minimum and maximum profits to be considered, for while two or more bidders might submit the same figure as to actual cost there might be some considerable difference as to the range between minimum and maximum profits that they would consider equitable.

As the contractor is guaranteed against loss each

TABLE I. PRICE SCHEDULE 10c, 20c, 40c, 80c, $1.60. MINIMUM PROFIT 10 PER CENT, MAXIMUM PROFIT 40 PER CENT.

Cost c.	Deduction from next highest price*	Pay Price c.	Profit c.	Profit %	Cost	Deduct* c.	Pay c.	Profit c.	Profit %	Cost c.	Deduct* c.	Pay c.	Profit c.	Profit %
					20		22.000	2.00	10	40	.	44.00	4.00	10
					21		23.10	2.10	10	42	.	46.20	4.20	10
10	....	11.000	1.000	10	22	....	24.20	2.20	10	44	.	44.40	4.40	10
10½	.....	11.550	1.05	10	23	8.50	31.50	8.50	36.96	46	17	63.00	17.00	36.96
11		12.100	1.10	10	24	8.00	32.00	8.00	33.33	48	16	64.00	16.06	33.33
11½	4.250	15.750	4.250	36.96	25	7.50	32.50	7.50	30.00	50	15	65.00	15.00	30.00
12	4.000	16.000	4.000	33.33	26	7.00	33.00	7.00	26.92	52	14	66.00	14.00	26.92
12½	3.750	16.250	3.750	30.00	27	6.50	33.50	6.50	24.07	54	13	67.00	13.00	24.07
13	3.500	16.500	3.500	26.92	28	6.00	34.00	6.00	21.44	56	12	68.00	12.00	21.44
13½	3.250	16.750	3,250	24.07	29	5.50	34.50	5.50	19.00	58	11	69.00	11.00	19.00
14	3.000	17.000	3.000	21.44	30	5.00	35.00	5.00	16.67	60	10	70.00	10.00	16.67
14½	2.750	17.250	2 750	19.00	31	4.50	35.50	4.50	14.52	62	9	71.00	9.00	14.52
15	2.500	17.500	2.500	16.67	32	4.00	36.00	4.00	12.50	64	8	72.00	8.00	12.50
15½	2.250	17.750	2.250	14.52	33	3.50	36.50	3.50	10.60	66	7	73.00	7.00	10.60
16	2.000	18.000	2.000	12.50	34	2.60	37.40	3.40	10	68	5.2	74.80	6.80	10
16½	1.750	18.250	1.750	10.60	35	1.50	38.50	3.50	10	70	3.0	77.00	7.00	10
17	1.300	18.700	1.700	10	36	0.40	39.60	3.60	10	72	0.80	79.20	7.20	10
17½	0.750	19.250	1.750	10	37	....	40.70	3.70	10	74	....	81.40	7.40	10
18	0.200	19.800	1.800	10	38	....	41.80	3.80	10	76	....	83.60	7.60	10
18½	.	20.350	1.850	10	39	.	42.90	3.90	10	78	. .	85.80	7.80	10
19	.	20.900	1.900	10										
19½		21.450	1.950	10										

*Equals one-half difference between cost and next highest price.

TABLE II.

Suppose the price bid as the actual cost to be 12c and the minimum and maximum profits 5% and 30%; 16c would then be the figure to which the following table is built to fulfill the conditions:

Cost	8	8½	9	9½	10	10½	11	11½	12	12½	13
Pay	10.4	11.05	11.70	12.35	13	13.25	13.50	13.75	14	14.25	14.5
Profit	30%	30%	30%	30%	30%	26%	23%	19.6%	16.67%	14%	10.46%
Cost	13½	14	14½	15	15½	16					
Pay	14.75	15	15.225	15.75	16.275	16.800					
Profit	9.26%	7%	5%	5%	5%	5%					

contract would give the contractor the profits on that contract and he would not be looking to make a succeeding contract stand the loss of a former. This is as it should be, for no matter what the conditions it is not fair to any of the parties concerned to carry a loss from one contract to another. Each contract would be required to meet the labor, material and weather conditions which exist during the completion of that contract. Unforeseen emergencies are provided for their actual cost instead of being figured as probable and the attempt made to provide therefore by tacking a lump sum upon the figure for which, under normal conditions, the contractor would be willing to undertake the work. It is not claimed for this method, however, that it leaves nothing to be desired, for under it the incentive would still exist to slur the workmanship in order to reduce the cost.

The contract being let at an estimated cost which carries with it a payment allowing a fair profit and the one letting the contract sharing in any saving or decrease in cost, he cannot in justness feel that the contractor has the best of it if the contractor makes a larger percentage profit, inasmuch as the latter would receive a total sum less than the estimated total. The method is not at all complicated, but is essentially a sliding-scale payment which readily fits into present practice of cost keeping and competitive bidding.—Engineering News.

A Review of Good Practice in Sewage Collection and Disposal

THOSE phases of sewage collection and disposal which are most closely related to sanitation and to the successful working of sewer systems and sewage treatment plants were reviewed in the progress report recently made to the American Public Health Association by the Committee on Collection and Disposal of Sewage. The report summarizes the best present practice in sewerage, and portions of it are here abstracted and quoted, as given by our Chicago contemporary, Engineering and Contracting.

COLLECTION OF SEWAGE

Sewage Intercepted for Treatment.—The best practice in intercepting sewage for treatment is to build an intercepting sewer parallel to the natural water course, into which the treated sewage is finally discharged, and to connect this sewer to the collecting sewers so that the dry weather flow of sewage and first flush of the rain storm flows into the intercepting sewer. During times of storm the excess rainwater and the very much diluted sewage overflow into the water course, for the expense of treating all rain water would be prohibitive. In England the requirements of the authorities stipulate that the storm water overflows shall only come into operation when the flow of sewage is increased six fold and the sewage works must be constructed to deal with six times the normal dry weather flow. Since the consumption of water in England is approximately 40 gals. per capita per day, and the consumption in America sometimes exceeds 200 gals. per capita per day, it is evident that the dry weather flow of sewage in America is nearly five times as dilute as that of English cities. Arrangements, therefore, for intercepting the dry weather flow of sewage and the first flush of a rainfall compare well with English practice.

Velocity of Flow.—The gradient of sewers should develop self-cleaning velocities. The best practice indicates that the velocity of flow should be not less than 2 ft. per second in the separate system and 2½ ft. per second in the combined system. Steep gradients, however, necessitate deeper trenches, and here, as in most engineering problems, a solution must frequently be found between the ideal and that economically possible. As a result, flatter gradients than will give the above named velocities are often used, and while more frequent flushing is made necessary, no trouble has resulted, provided the sewers are constructed with due care to obtaining a smooth interior surface. Where the expense of obtaining steeper gradients is material, an actual velocity of 1 ft. per second in a well constructed sewer, taking domestic sewage, will, with a reasonable amount of flushing, keep the sewer clean. Trade wastes of certain character, however, require higher velocities to prevent deposits.

Ventilation.—Ventilation of the system becomes a problem where the sewers are not kept clean by the normal flow, or by flushing. Unless deposits form and decomposition results, there is little odor from sewage, and the danger of disease transmission by sewer gas negligible. The omission of the house trap and the use of the main riser through the house to a point above the roof, is the most effective means of inducing circulation of the air in the sewers, and with proper inspection of the plumbing system, involves no danger, but the best solution of the problem of ventilation is, as already stated, to maintain clean sewers.

Trade Wastes.—Sewer systems are primarily designed and built to carry domestic sewage and rain water. The introduction of trade wastes having certain characteristics is therefore liable to injure the sewers in the following ways:

(a) Heavy mineral solids, such as lime from glue works, dust from marble yards, etc., can form deposits in the sewers which retard the flow and reduce the carrying capacity.

(b) Gelatinous materials, hair from tanneries, grease from wool works, and similar substances, by adhering to the perimeter, increase the roughness of the interior surface and so reduce the carrying capacity.

(c) Acid wastes injure the cement joints between brick work or pipes, or attack concrete, causing leakage and destruction of the fabric of the sewer.

(d) Liquids of high temperature may soften and injure the bituminous joints in pipe sewers used to prevent the infiltration of ground water.

(e) The discharge of live steam, volatile liquids or inflammable gases, or the sudden emptying of vats of hot water, cause a serious menace to men working on the sewers.

Trade wastes having the above properties should be strictly excluded from the sewer system, unless submitted to sufficient treatment to remove the objectionable characteristics—as, for instance—the wash water from garages contains gasoline, which can be easily removed by passage through an intercepting tank, as required in London.

In regard to the admission of other trade wastes it may be said that it is cheaper to dispose of manufacturing wastes in combination with the sewage than separately, and sometimes purification is only made possible by admixture with the sewage. Generally, it is good civic policy to aid manufacturing interests by providing an outlet for the liquid wastes, but obviously, since there is no greater obligation on the part of the community to take care of liquid than of solid manufacturing refuse, the power should be given those in authority to levy special assessments, based on some logical expression of the increased cost of maintaining the sewerage systems caused by the entrance of these wastes. Further, it is evident that in many cases preliminary treatment of the manufacturing wastes must be required, and none should be admitted which will injure the sewer, increase the cost of maintenance beyond that involved in independent disposal, or prejudicially affect the treatment of sewage.

Ground Water.—The reduction of the leakage of ground water into sewers where treatment of the sewage is required, is a feature which is of sanitary interest. Many disposal plants are overworked, and overflows into the neighboring water-courses made necessary because of leakage in the seasons when the ground water is high. It is believed that the expenditure of the money necessary to secure tight joints is well justified and should be given careful consideration.

In connection with the reduction of leakage, it is good practice to lay underdrains beneath the sewers, lowering the water-table, and, by improvement of subsoil conditions, subserve the interest of public health.

Finance.—While not strictly within the scope of this discussion, a few words in regard to the financing of a sewer system may not be out of place. Very frequently the sanitary necessity for improved sewerage is confined to a limited section of the town or city. Those living outside of this more congested section are satisfied with their present method of individual disposal, and oppose the undertaking of a municipal system. The result is that very often the work is thus delayed because of a feeling that the entire community will have to pay for something from which only a part will obtain commensurate benefit. The answer lies in a proper method of assessment, which will require contributions in proportion to the benefits conferred. Thus, if a small part of the total expense is met by a general levy on all property to express the sanitary betterment to the entire community, a larger part is raised by assessment on property abutting on streets where sewers are built, whether these sewers are used or not, and, a still larger part is obtained by rentals for actual use, the relative benefits will be fairly indicated, and the opposition to the improvement by those not particularly in need of sewers may be thus removed.

In planning a comprehensive sewerage system it should be borne in mind that the discharge of sewage from a town into a stream through a number of sewer outlets is less likely to overtax the diluting power of that stream than when the intercepting sewer has collected all the sewage of the town and discharge it at one point.

Sewage Treatment

Need for Economy.—Viewing the problem broadly, it is a fact that to purify sewage to a degree which will render it innocuous to health will entail an expense which is not commensurate with the benefits to be derived therefrom. The tax rate in American cities is rapidly increasing, owing to rapid growth and the demands of modern civilization. Municipal funds may be used to greater advantage and benefit in other ways than attempting to purify sewage to the complete elimination of its potentially dangerous qualities.

Recognizing the basic fact that surface waters are bound to be polluted, and recognizing the futility of attempting in general to render the sewage innocuous to health; that is, to destroy all the pathogenic germs it may at any time contain; it then becomes necessary to determine to what degree sewage must be treated.

The Degree of Treatment Required.—To determine the degree of treatment required for sewage in any particular case requires consideration of the whole water-shed of the stream. On a large drainage area there are usually a number of communities which have a unity of interests. It is not always possible to prescribe the exact degree of cleanliness which should be maintained in the water-course, because it will differ with each stream and at different points along the same stream. As, for example, in the case of two communities, one near the head-waters of the stream and having several communities below it; the other near the mouth of the stream, which may be a tidal estuary.

The degree of treatment required in each case will depend on the amount of pollution permissible in the light of the use to be made of the water of the stream below the point of discharge of the effluent.

These are cases where it is doubtless expedient and wise to purify sewage to a greater degree than in others, as, for instance, where numerous cities and towns are located within a relatively close distance of one another and each taking its water supply from and discharging its sewage into the same river.

Other things being equal, it is always easier to satisfactorily purify and render safe a polluted water the less polluted that water is.

Logical reasoning forces the conclusion that all waterways are necessarily polluted, and where such waters are used as a source of water supply, that they should be purified before consumption. Basicly, the broad problem may be stated as follows:

1. Sewage, or effluent from treatment works must continue to be discharged in increasing quantities into running waterways and tidal estuaries.

2. The establishment and maintenance of conditions offensive to the aesthetic senses through such discharge of sewage must be guarded against.

3. Where sewage is treated so that upon its discharge into the rivers and tidal estuaries no offensive conditions are set up as regards objectionable appearance and odors, and no undue load is placed upon the water filters within the influence of the sewage discharged, and where a suitable margin of safety is allowed; the problem of sewage disposal, broadly speaking, has been solved.

With few exceptions, all sewage should receive some form of treatment, in order that offense shall not result. These refer, first, to overtaxing the digesting or oxidizing power of the diluting stream; second, to the formation of sludge deposits on the bed and banks of the stream, these deposits putrefying later and setting up and maintaining offensive conditions; and, third, the presence of floating material and oily sleek.

Omitting from the problem of sewage disposal the influence of water dilution and adequate velocities, screening to remove floating matter is the minimum degree of treatment required in any case. Usually, however, it is necessary to go further and remove the heavy suspended matter, leaving only that which is light enough not to deposit in the stream and if the flow of the stream is sufficient to dilute the clarified sewage and prevent offense the problem is solved.

The reasonable solution would appear to be a study of each problem in the light of minimum stream flows and volume of sewage, and under summer conditions. The character and extent of treatment of the sewage should then be adequate to meet these extreme conditions.

Even though water filtration be used the source of water supplies should not be so polluted, but that in cases of emergency the raw water cannot be sterilized and delivered safely into the mains. This points to the proposition that to preserve the public health it is not only necessary to purify the water supply, but also to protect its source. It is feasible, for short periods, to render river water that is slightly contaminated pure and wholesome for domestic use through the application of a chemical germicide; but such mode is not sufficient where the water is very much polluted with sewage. Existing statutory laws of the several states differ. Constitutional provisions necessarily control to some extent. Uniformity of laws will not be approached until there is some Federal authority, like a national board of health, whose duty, among other things, it shall be to exercise proper control over interstate stream pollution.

Trade Wastes.—The trade waste phase of sewage disposal is perhaps more difficult of satisfactory solution than the main sewage problem, for the following reasons:

Trade wastes come from industrial development which constitutes the financial back-bone of the country's welfare.

If the industries are compelled by certain local conditions to purify their wastes before discharge to a greater degree and at a higher cost than their competitors more favorably situated, where competition is sharp, their business profits may be seriously affected and even result in their financial ruin.

Generally speaking, the presence of trade waste, in the proportion usually found in normal city sewage, does not affect the efficiency of sewage treatment.

Where, however, large industries add certain wastes to a sewerage system, the treatment works of which were designed for purely domestic sewage, it is possible that the works may be totally unable to successfully treat the mixture.

Industrial wastes are frequently discharged from tanks in large volumes during a short time. This places an unnecessary burden upon the treatment works and can be prevented by the discharge of such tanks at a slow rate.

There are trade wastes which, under certain local conditions, affect the efficiency of water purification works, adding to the expense of their operation and even seriously affecting their hygienic efficiency. When such injurious conditions are caused by trade wastes two solutions appear possible:

1. For the producer or manufacturer to so treat the waste before its discharge that the obnoxious conditions are removed.

2. For the producer or manufacturer to reimburse the affected parties for the additional cost of treatment caused by the trade waste.

Removal of Suspended Matter from City Sewage

The minimum amount of treatment usually consists in the removal of the coarser suspended matter and the heavy mineral detritus. The use of coarse screens will prevent the offensive appearance of a water-course caused by floating solids of sewage origin, and the silting up of the point of discharge is prevented by the retention of the detritus in grit chambers.

Where the diluting power of the stream is not sufficient, or where velocities of flow are such that deposits would form, which, by decomposition and putrefaction deplete the water of its natural oxidizing powers, more suspended matter must be removed from the sewage. This can be accomplished by the use of either fine screens or sedimentation tanks. If the settling solids are removed by tanks the deposits of sludge are prevented. The biological forces of the water-course, therefore, are only required to care for the finely divided and soluble organic matter of the sewage effluent.

While dilution may care for the liquid effluent after sedimentation, the sludge removed from the fine screens or from the tanks must be handled in a sanitary manner. Screening stations usually are accessible to power or garbage disposal plants where the screenings can be burnt.

In Germany, and in this country, it has been shown that the separation of the settling sewage and the decomposing sludge in two-storey tanks will keep the sewage during its retention nearly as fresh as received. If the sewage be stale and odorous, however, this type of tank has no deodorizing effect, as its only function is the removal of suspended matter and decomposition of sludge.

The sludge withdrawn therefrom is practically odorless, drying quickly, and is suitable for filling low land or lightening heavy soil for agricultural purposes.

Removal of the Putrescence of Sewage.—Where sewage must pass into water-courses of limited volume, or where for sanitary reasons it is necessary to still further treat the sewage, the removal of the settling suspended matter is supplemented by biological treatment in prepared beds. The sewage should preferably be freed of its settleable solids before such treatment in order to secure higher rates of operation.

The intermittent filtration of sewage on sand beds accomplishes complete treatment, inasmuch as the suspended matter in the crude sewage applied is collected at the surface, the organic matter is almost completely oxidized in the pores of the filters and the bacteria largely removed by the smutzdecke. The rate of filtration is necessarily low.

In bacteria beds or the rapid coarse grain filters, however, the action is much less complete, since it only converts the putrescible material into fairly stable forms, so that when such an effluent is discharged into the water-course the purification begun in the artificial works should continue.

Design and Operation of Sewerage Works

It has already been stated that expert services are required for the efficient design of a sewer system and treatment works. Equal necessity exists for the skilled supervision of the operation of these works, the extent to which such supervision should prevail depending upon the type or class of works. It is possible to determine along general lines what the proper attention for each class of plant should embrace. It follows that skilled supervision of the operation of sewage works must be compulsory. State or Federal control is indispensable, although supplementary in character.

The foundation for efficient and economical operation of sewage treatment works generally must be based upon careful statistics of operation. Records of daily operation of works should be uniform for the same class or type of plant and to enforce such records requires the exercise of not only local but also of state and national police power.

The need of proper management of works is well expressed by Mr. John D. Watson, as follows:

One word with regard to management. However well a plant may be designed, if it is not well and skillfully managed it will become a nuisance and bring discredit to the engineer who designed it. The disposal of the liquid filth of a great community has an enormous potentiality for evil and if a town authority believes it necessary to avert this by expending large sums of money on constructional work, it is their bounden duty to see that the plant is placed in the most competent hands. Local authorities are by no means sufficiently alive to this aspect of the question, with the result that too many works are left to the management of untrained men. Hitherto anybody has been deemed good enough to look after a sewage work, but the day has now come when the manager should be a highly trained technical expert, if a local authority hopes to get full value out of the sensitive entity which we call a bacteria bed.

Laboratory Control.—The operation of a sewage treatment works is usually controlled by laboratory observations. The methods generally used are largely adapted from the sanitary examination of water, and in many ways this work could be simplified.

What the operating engineer needs to know is whether each part of the works is being operated at its maximum efficiency and whether the final effluent is suitable for discharge into the stream to maintain the standard set for that stream. For the purposes of comparison with other cities more complete analyses are often desired of the crude sewage and of effluents. For instance, in the operation of a grit chamber the only important observation is the percentage of the dry residue which is organic, for if it is too high the velocity of flow through the grit chamber should be increased.

In the operation of a percolating filter it is most important to know whether the filter is delivering a stable effluent, and the storage and unloading of the suspended matter.

The most important facts required on sewage or effluent are the amount of settling material contained, the avidity for oxygen, and possibly the prevalence of pathogenic organisms.

The methylene blue test for stability marked a considerable advance, but even this has its limitations owing to the need of more extended data. Perhaps if natural conditions could be more nearly imitated the results would be more valuable. Small sample bottles, incubated air tight, afford quite different conditions from those existing in a normal stream with its constant absorption of oxygen from the air and the addition of oxygen liberated from green plants in the water.

Tests which show the results of the biological activity in the exhaustion of available oxygen in the sample tell more clearly the fitness for an effluent to be discharged than the quantitative chemical analyses of the sample.

The Midland Railway Company is taking steps towards the establishment of a new industrial centre in Winnipeg, on property adjacent to its trackage. Water service is to be installed for the benefit of firms locating on this property, together with sewers, electric light and other modern conveniences. The district will be laid out on the most approved lines, with broad thoroughfares, and every inducement will be offered to industrial firms to settle on the property of the company, where the best of railway facilities will be available.

Terra Cotta Walls

NEARLY all builders are familiar with hollow tile for fireproofing large steel frame buildings, but terra cotta is something quite different, and used without a framework of steel. In short, terra cotta hollow tile are specially designed and manufactured blocks which take the place of bricks, stone or other like materials in the walls and partitions of a building. They support the floors and roof just as other walls do, but they do far more than that and far more than other building materials, and these different functions are what we want you particularly to notice.

Everybody knows that air cells make the best possible insulator against the passage of heat. Terra cotta hollow tile divide the walls up into a multitude of air cells, and these cells prevent the passage of heat through the wall from outside to within, or from within to outside. As a result, any building having walls of hollow tile is warmer in winter than buildings of other materials, for the heat generated by the heating apparatus within is not dissipated from the walls of the building; while in summer weather the house built of hollow tile is cooler than any other, because the heat of the sun beating down on the walls cannot penetrate to the interior. The economy of hollow tile walls follows as a natural consequence of the non-passage of heat. The conductivity of walls is one of the great heat problems of the heat engineer, more heat being being required to keep the walls warm than to heat the interior.

But hollow-tile blocks are not the only kind of building materials which resist the passage of heat. Stone and brick walls do likewise, although not to so great an extent. Stone and brick walls, however, while they prevent to a certain extent the passage of heat, very freely conduct water into the building. Capillary attraction and the solid nature of the walls are the causes leading to this result. With terra cotta hollow tile, on the other hand, there is no capillary other than that necessary for the holding of mortar; even if there were, the air cells formed in the wall by the partitions in the hollow tile would prevent any moisture whatever from reaching the interior of the building. This difference between walls of solid masonry and those of hollow tile can be seen by examining the furniture in houses built of the different materials. In a stone wall building you will find that the keys in the piano stick after the house has been shut up without heat for a few days. In a terra cotta hollow tile home, heat can be shut off indefinitely without any evidence whatever of dampness becoming apparent. This saving of furniture, together with the saving of fuel and saving on insurance will go a long way toward making hollow tile buildings the cheapest as well as the best type of building in the long run.

A feature of home building which heretofore has received but scant attention from architects and builders, but which is of prime importance to the owners or occupants of a building, is perfect privacy in the home. What is more annoying to sensitive persons than a home, hotel or other building, for that matter, where there is no privacy? When anything is said or done it is telegraphed all over the building by the frail-lathed partitions acting as sounding-boards.—Construction News.

History of Water Sterilization by Chemical Methods[*]

By S. Rideal, D.Sc., F. I. C.

BEFORE entering on the subject it would be as well to lay down certain principles clearly, at the risk of speaking truisms: Drinking water has got to be wholesome, not sterile. What we have to do is (1) to prevent the entrance of disease organisms, (2) to kill them if they do enter. In both subjects the engineer and the chemist must collaborate, and the bacteriologist must keep watch.

It has been many times supposed that you could get perfectly innocent water for a city by going far enough to mountain gathering grounds, collecting all the brooks into a reservoir, and sending the water down by a long conduit. Such aqueducts in Great Britain range from 43 to 99 miles. The original water of the brooks is by no means pure bacterially owing to animals, even if the watershed is cleared of human beings. The British Local Government Board reports give several instances of epidemics occasioned by upland water. We may presume that during the long transit the pathogenic bacteria will disappear, but this is a very expensive way of attaining the object.

Pollution of rivers, both by sewage and by manufacturing effluents, had reached a flagrant and dangerous degree, but has since been greatly abated in most countries, and by sand filtration a water of considerable purity is obtained from rivers by a majority of communities. I need hardly dwell on the obvious advantage of this course. The river is adjacent; constant attention to the cleanliness of its bed and the inoffensiveness of its water are imperative for sanitary and commercial reasons. On the other hand, a long aqueduct is enormously expensive for construction, maintenance, and care against lateral contamination, besides the fact that the water is not always initially unimpeachable. Cities and towns are built on rivers, and why should we not use the water brought to our doors? No city depending on a long conduit is safe from a water famine for three chief reasons: (1) Accident, (2) drought on the uplands, and (3) the possibility, which we may think remote, of an enemy destroying the aqueduct. The last reason led to the ruin of many cities in history.

Purification Always Necessary

Dependence on wells is of limited application, and is notoriously unsafe; even deep wells in chalk are liable to pollution through fissures. The fact of the matter is that a system of purification is needed in all cases. Disease bacteria are apt to penetrate sand by "growing through" or by their minuteness: therefore the product of sand filtration is not always innocuous. Dr. Houston, in London, recommended storage as a method of rendering Thames water safe, but the storage must be for not less than two weeks, and might with advantage be for from one to two months. This involved the construction of enormous and costly reservoirs for London's water supply, and, in addition, the raw water must first be passed through settling basins to remove coarser impurities. Even then, in the Seventh Report of the London Water Board, December, 1911 (p. 36), it is found that, "despite the remarkable improvement effected by storage . . . . it seems unwise to trade too greatly on this circumstance if any practicable remedy, even of a partial kind, is available." Later, in the Eighth Report, of February, 1912, Dr. Houston, after investigation, proposes an "excess lime" method, founded on his observations that "quicklime (about 75 per cent. CaO) added to raw Thames water in the proportion of 1 part of this quicklime to 5,000 parts of water, kills B. coli in from five to twenty-four hours . . . and, inferentially, but certainly, the microbes also of epidemic water-borne disease—e.g., the typhoid bacillus." The excess of free lime is to be then neutralized by one-third of the volume of "adequately stored water," which must, of course, be previously examined.

This is one way of chemical sterilisation which has been often tried, the attraction being the cheapness of lime, and also the softening effect on the water. It is really, however, an expensive one on account of the amount of lime needed—equal to about 1 ton per 1,000,000 gallons, and there is the need to test the water both before and after the process, and, in addition, the difficulty of getting rid of the huge deposit of carbonate of lime formed.

Several more efficient sterilizers have been introduced, but to work with economy must always have the proviso that the water is at least roughly filtered beforehand, in order not to waste the reagent on such matter as can easily be separated mechanically. The introduction of mechanical filters has made the operation comparatively simple, and enables necessary chemicals to be added under control. It has been pointed out that the unstable yet powerful bacterial toxins are not likely to be destroyed by the comparatively mild oxidising agency of the mechanical filters, or even by the sand filters, in the winter. They are removed, neutralized or destroyed, however, by the best methods of chemical sterilization.

We may rapidly pass in review a number of the sterilisers available under certain circumstances. In 1892 Dr. Christmas showed that 1 in 100,000 of citric acid was fatal to cholera organisms, but that ten times the quantity was required for typhoid organisms. This amount gave an acid taste, and was unduly expensive. In 1901 Dr. Parkes and myself introduced the use, for possibly polluted waters in the field, of tabloids of bisulphate of soda. These removed any danger of enteric origin.

As to copper salts, you are more familiar with their use in America than we are in Europe. I have published some researches on the point which agree with other investigators in showing that, employed in rather large proportions, they kill objectionable algae, but are not of much good against bacteria. A fault is the immediate precipitation of the copper salt by the natural carbonate of lime in the water, and, although an insoluble copper salt can act germicidally, as proved by the use for phylloxera, the action is local and irregular. The application, accomplished by towing boats with bags of sulphate of copper over the reservoir, has been expensive, and it is very difficult to make it uniform. Subsequent filtration is necessary, and there is a chance, even then, that traces of copper may remain in organic solution, so that it is fortunate that there are safer methods.

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[*] Paper read at the Fifteenth International Congress on Hygiene and Demography, held at Washington.

Numerous Oxidising Agents Have Been Employed

Potassium permanganate was used on a large scale for the drinking water of the soldiers in the Franco-German War of 1870, and in India it was widely applied to wells and tanks, which were regularly "pinked" by officials as a defence against cholera. Later reports on the efficiency of the practice have, however, been unfavorable. In 1899 I suggested the use of sodium peroxide; it reacted with the dissolved carbonic acid, giving nascent oxygen and sodium carbonate, so that softening and sterilization were done together. The quantity required for sterility varied between 1 in 1,000 and 1 in 10,000; cholera was killed in eight hours, typhoid in six. Reichel (Z. f. Hyg., 1908) found that 1 in 2,000 of hydrogen peroxide killed B. coli in twenty-four hours, and 3 in 2,000 sterilized in six hours. Hetsch stated that calcium peroxide was more energetic, and it was sold for the purpose under the name of "bikalzit." Magnesium peroxide (Croner, ibid, 1908) is made for the same object by the "Oxidinsterilisierungswerken," but is likely to introduce magnesium hardness.

Bromine (Braithwaite, Schumberg, 1897-98) and iodine (Allain at Marseilles; Vaillard, Arch. de Med. milit, 1902) have been limitedly used for water treatment in emergencies, but are objectionable. Even the fluoride and silicofluoride of silver have been placed on the market as water sterilizers under the names of "tachyol" and "isotachyol." (Gaz. Chim. Ital., 1907).

A condition of drinking water sterilization is that no substance should be left behind which can in any way be injurious to health, and, if possible, that nothing extraneous to the water should remain. It is at the same time a disadvantage if a disinfectant, however powerful in its first onset, is very evanescent, as many disease germs are strongly resistant, and we know that the time factor is of extreme importance in sterilization.

Ozone Used Considerably

In the first of these conditions ozone suggests itself as an ideal reagent, producing nothing by complete oxidisation of organic matter but carbonic acid and water, while the combined nitrogen is partly liberated in the free state and partly oxidised to harmless nitrates, and the organic sulphur and phosphorus give equally innocent minute quantities of sulphates and phosphates. It has been asked whether intermediate compounds might not be formed which could have some physiological effect. I have not found any such in my examinations of the process, and the water is singularly pure afterwards. Ozone is now rather extensively used in Europe for sterilising partly purified water. In 1908 I was called upon to examine the De Frise system at the Paris waterworks of St. Maur, and found very successful results. The river Marne water, after ordinary sedimentation and filtration through gravel and sand, was still unfit for a supply, but by afterwards ozonizing it gave a well-aerated brilliant liquid of natural bluish tint and quite inodorous, containing per cubic centimetre only one or two innocuous organisms of the subtilis type. The coli test became invariably negative, although altogether 1,580 cubic centimetres were examined, with a maximum of 200 cubic centimetres at one test. I found that 57 kilowatt hours per 1,000,000 imperial gallons were required for the sterilizing operation, and 76 kilowatt hours for pumping. These figures would be reduced to 47.5 and 63.4 kilowatt hours respectively per 1,000,000 United States gallons. The De Frise apparatus used Siemens-Halske ozonizers with a simple and efficient ozonizing tower and a circuit by which ozone escaping after action was returned and used again, thereby effecting an important economy. The Paris Municipality decided, in July, 1910, that the part of the city drinking supply derived from the Marne (about 20,000,000 gallons daily) should, after coarse filtration, be sterilized by ozone—half by the De Frise and half by the combined Otto process. The latter employs "emulsers," which are injectors effecting a mixture of ozonized air with the water, the action being completed in "columns of self-contact." Ozone sterilisation has been installed in about thirty French towns, in Roumania for the Danube, at St. Petersburg for the Neva, at two waterworks in Holland (the pioneer), Belgium, Germany, Italy, Spain, Brazil and Egypt, and experiments have been undertaken at Darjeeling, in India, while an installation is in course of construction at the Knutsford waterworks, Cheshire, England.

Other processes differing in mechanical details are the Vosmaer, tried at Philadelphia, and the Howard-Bridge, at Lindsay, Ont.

St. Petersburg Has Largest Ozone Plant

The largest plant at present is that at St. Petersburg, Russia, for 11,000,000 gallons per day. The water is first treated with sulphate of alumina, then passes on to thirty-eight sand filters at a rate of 1,000 gallons per square metre of filtering surface per hour, and finally enters the five sterilising towers along with ozonised air. There are 128 Siemens-Halske water-cooled ozonizers. The air is freed from moisture by refrigeration, and is ozonized to the degree of 2.5 grammes per cubic metre. The total cost from the raw river to the finished water was recorded in 1911 as 0.86d. to 0.97d. per 1,000 gallons. At St. Maur, Paris, M. Colmet Daage estimated that the cost, under the most favorable circumstances, was 0.31d. per 1,000 gallons, excluding interest, amortisation and repairs. At Nice, where cheap water power is available, the average last year was given as 0.164d. per 1,000 gallons, and at Rimiez, where there is, besides, no pumping, it was only 0.125d. A portable ozone purifier has been adopted by the Spanish Government for the water supply of armies in the field.

The preference for ozone as a water-sterilizing agent has been hindered by several difficulties. One is the question of expense. In this regard the manufacture has been considerably cheapened. Another is that it has to be applied in the gaseous form diluted with air so that a large quantity of inert gas must be pumped, and with this admixture the ozone does not very readily dissolve. The latter fact has been overcome by using towers and saturators, as mentioned above. Moreover, the conversion of oxygen into ozone is a reversible action, requiring a number of precautions as to detail. In spite of the numerous researches, the best conditions are not yet fully agreed on; therefore, we have not reached finality in the economy of ozone production. It is stated that "the best results ever obtained with a silent discharge apparatus gave 36.7 grammes of ozone per kilowatt hour, the theoretical yield being over a kilogramme." A certain amount of the loss is due to the formation of ultra-violet light in the machine. When an ozonizer is acting properly the interelectrodic space has an almost uniform violet illumination, without any sparking. Regener (Ann. d. Physik, ix., 1,033, 1906) showed that the presence of ultra-violet light limits the concentration of ozone within certain limits, above which it exercises a de-ozonizing effect. These rays are well known to have also a sterilising action, and my son, Eric K. Rideal, has devised an apparatus in which both activities are utilized. (English patent 18680 of August, 1910).

Siemens and Halske have several devices for preventing corrosion of the metallic parts of the apparatus. British patent 17787, of 1910, reverses the usual procedure by drawing ozonized air through the water instead of forcing it through from below, so that the main work shall be done, and the ozone almost entirely used up, before entering the pumps. This appears expensive mechanically. Their French (international) patent 431402, of 1910, introduces small quantities of water into the pumps at the same time that the gas is admitted.

The Chlorine Process

Chlorine sterilisation is effected in practice by means of hypochlorites prepared either chemically or electrolytically. It will be well known to you that "chemical chlorine," chiefly chloride of lime, is largely used in America; it is also employed at some places in Europe and in India. After three noted epidemics of typhoid in England, chloride of lime was used at Maidstone for disinfecting the mains, pipes and reservoir; at Lincoln for the city water supply; and, quite lately, for the same purpose at Cambridge. At Johannesburg the Witwatersrand supply is sterilized by the addition of chloride of lime equivalent to 0.25 to 0.5 part per 1,000,000 of available chlorine. (Leitch, Proc. Inst. Civ. Eng., London, 1911).

The objections to the lime compound are avoided by electrolytic hypochlorite, which, having soda as a basis, leaves behind only an unimportant residue of common salt, and slightly softens the water, besides having, apparently, a somewhat greater bactericidal effect. The addition of 1 to 2 parts per 1,000,000 of available or active chlorine, which is all that is generally needed, does not affect the taste, and even where a water is excessively polluted, and more is necessary, the product is even then not brackish like many present supplies.

I first began trials on a large scale at Maidenhead, England, in 1898, and found that 17 parts per 1,000,000 of available chlorine killed, in fifteen minutes, all the organisms in a filtered sewage effluent entering the Thames. In 1904, at Guildford, I observed that, with 2.5 parts per 1,000,000, tertiary effluents were practically sterilised—in fact, were purer bacterially than the town water supply. I next tried experiments on the latter, which contained ninety organisms per cubic centimetre, with coli present in 4 cubic centimetres. After treatment with 0.75 part per 1,000,000 of available chlorine, the total organisms were reduced in five hours to fourteen per cubic centimetre, and coli was absent from 20 cubic centimetres. A portion purposely infected with 100 coli per cubic centimetre was treated with 0.8 part per 1,000,000 of available chlorine, and after one hour's action there were no coli present in 20 cubic centimetres, and this condition remained for a considerable distance in the channel. Since then I have been directing the application of chemically prepared sodium hypochlorite to 100,000 imperial gallons daily to the drinking water supply of a North of England town with success, in the proportion of 1 to 2 parts available chlorine per 1,000,000; practical sterility is attained; there are no coli in 75 to 85 cubic centimetres, and the taste is not affected.

Not sufficient notice has been taken of an explanation I gave in 1909, at the Leeds Health Congress (J. R. San. Inst., London, xxxi., 2), of the fact that with hypochlorites the first rapid consumption is succeeded by a slower action, which continues for some hours or even days to favor sterility. It is due to the formation, by the action of chlorine on ammonia and nitrogenous organic matters, of strongly germicidal compounds, chiefly chloramine, NH_2Cl, and hydrazine, N_2H_4. These, in the traces present, are not injurious to higher animals, and soon disappear. The removal of any residual traces is hastened by cascades which have also been used with success in ozone treatment.

Value of Testing

A great advantage both of the ozone and chlorine processes is that they can be so easily controlled by the starch-iodide test. It is sufficient to observe that the reagent is faintly blued by the treated water to insure adequate sterilization. Systematic testing in this way avoids the risk of underdosing or overdosing, and does away with the need of removing any excess of the sterilising agent by a secondary treatment, such as the addition of sulphites or filtration through prepared charcoal or iron turnings and sand, processes that increase cost, time and space required. I have found that if the process is controlled, as above, without such further treatment, the water usually becomes free from odour and taste in one and a half hours.

The cost of chlorine sterilisation will, obviously, depend greatly, among other things, on the price of materials. If 1 part per 1,000,000 of available chlorine be required, and if its cost be about £14 per ton when derived from chloride of lime, and £21 per ton when made as sodium hypochlorite (J. Soc. Chem. Ind., Jan. 31, 1912), this item alone will reach 0.022d. in the second. The lime compound is more suitable for sewage than for drinking water, since it increases the hardness and affects the taste. There is for many reasons an advantage in making sodium hypochlorite electrically at the waterworks, especially if cheap power is at hand.

The Ferrochlor (Duyk) method adds about 8 parts of ferric chloride and 0.2 part of available chlorine as bleaching powder per 1,000,000 gallons of water to effect coagulation and sterility. One objection is that it is advisable to do all coagulation and sedimentation before sterilizing in order to avoid recontamination.

Three Suggestions for Good Concrete Pavements

By James O. Heyworth.

The most important features to be considered in concrete highway construction, in my opinion, are:

1—Do not use a top mortar finish, unless it is applied simultaneously with the foundation concrete.

2—Construct the pavement as monolithic as possible, avoiding blocking it off into small units. I consider a small unit less than 100 square yards and suggest that 100 square yards be considered a minimum. Would recommend making the units, 1,000 to 3,000 sq. yds. or more.

3—Do not make pavement too narrow and thereby force vehicles to travel over the same part of the pavement, forming ruts, but provide a good liberal margin to act as a shoulder and thus prevent breaking off the sides of the pavement.

Ottawa Water Supply—Accepted Report

Recommendations of Sir Alexander Binnie Finally Approved—The Thirty-One Mile Lake Scheme, Which Involves a Cost of Nearly Eight Million Dollars

THE solution of Ottawa's water supply problem appears to be at hand. After having reports prepared upon all available sources of supply the City Council, upon October 17th, approved and passed the scheme of bringing water from Thirty-one Mile Lake in accordance with the recommendations of the English expert, Sir Alexander Binnie. The estimated total cost of the undertaking is $7,985,000, and the time of completion is placed at nearly four years from date. Copious extracts from the report are given below:

Thirty-one Mile Lake and Pemichangaw Lake are situated on the east bank of the Gatineau River at a distance of about forty miles to the northward, measured in a straight line from Parliament Hill to the south end of Pemichangaw. The surrounding area of land which drains to these lakes is dotted with numerous other smaller lakes, but the above mentioned are the only lakes of any importance and extent.

The quantity of water which can be derived from any given drainage area depends on three factors:—1, the extent of the drainage area, which in this case would be 150 square miles approximately; 2, the quantity of rain or snow which is annually precipitated on that drainage area; and, 3, the proportion of the precipitation which flows from the ground and can be collected, known as the run-off.

Taking 13.6 inches of rain on the catchment area of 150 square miles, the average yield would be during the three driest consecutive years approximately 81 million gallons per diem, and would, therefore be ample to meet the requirements of a population of 750,000 persons.

Quality of the Water

Apart from bacteriological or chemical examination the character of a water can be very largely predicted from an examination of the drainage area. In this case the rocks are gneiss and crystalline lime stone and are apparent at or near the surface over almost the entire drainage area which is covered with trees and undergrowth, very little clearing having been done, the entire resident population amounting to only 130 persons, or less than 1 to the square mile. In addition to this resident population there are a certain number of summer visitors and lumbermen, who are at work round the lake in the early summer months. The shores shelve rapidly into deep water almost all round the lakes and the islands with which they are dotted. No soundings have yet been taken except at certain points, but we are informed that there are places in the lakes over 200 feet in depth. The drainage area has now been examined at a great number of points and has been found free from peat or other surface deposits liable to discolor the water, and the total area of swampy ground is insignificant. It might be expected that water flowing from such a drainage area would be of exceptional purity and such is the case. This water, having been under observation during the whole of this year, has always proved to be bright and clear, the bottom being plainly visible at great depths. About the beginning of September certain organisms called Rhysopods make their appearance in all the lakes examined, except some of the small ones, and disappear in a short time. In appearance they resemble minute sea urchins but are plainly visible to the naked eye, and are, in fact, of such dimensions as to be readily removed by fine mesh screens. It will therefore be necessary to provide such screens at the outlet to prevent both these organisms and fish from entering the pipe. If steps are taken by the City to prevent contamination in the future by human pollution there will never, in my opinion, be the slightest necessity to filter this water, and should Ottawa adopt these lakes as a source of supply one of the finest water supplies in the world would be secured.

Method of Collecting and Storing the Water

There are four lakes which form a chain stretching approximately north and south. Commencing at the north is Mitchell Lake, a small lake which discharges through a narrow gorge at its outlet into a channel which finds its way into the Gatineau. This lake has a surface area of .7 square miles, and water level in September was 523 feet above datum. It receives the entire discharge of Thirty-one Mile and Pemichangaw, and the narrow rocky gorge already referred to forms an admirable site for a dam. The next in the chain towards Ottawa is Thirty-one Mile Lake which is about 18 miles in length with a water area of 18 square miles, the water level this summer being about 530 feet above datum. Immediately to the south, and separated by a narrow neck of land, lies Pemichangaw with a water area of 6 square miles and a length of about 5 miles, the water level this summer being about 552 feet above datum. Crossing the height of land to the southwest of Pemichangaw we come to Long Lake, having a length of about 1¼ miles, and a water area of about one quarter of a square mile. The distance between Pemichangaw and Long Lake is about 3,000 feet, and the water surface of Long Lake is 561 feet above datum. It is proposed to tunnel through the ridge between Pemichangaw and Long Lake and by means of the dam at the outlet of Mitchell Lake to bring all the lakes to one level, namely, 570 feet above datum, and to start the aqueduct to Ottawa from the south end of Long Lake. This would mean raising Mitchell Lake 47 feet, Thirty-one Mile Lake 40 feet, and Pemichangaw Lake 18 feet. The contour surveys to determine the top water area at this level are not yet completed, but it may be roughly assumed that the total top water area of the lakes when brought to this uniform level of 570 feet above datum will increase to about 35 square miles in area. One foot difference in level of a water surface having an area of 35 square miles represents about six thousand one hundred million gallons, and 18 inches would give a year's storage of a daily flow of 25,000,000 gallons, 3 feet would give sufficient storage for 50,000,000 gallons per diem, and 4 feet 6 inches sufficient for 75,000,000 gallons per diem. The maximum variation in water level would therefore be small.

Steps to be Taken to Afford Immediate Supply

It has already been stated that the dam would be constructed so as to raise the level of the lake to 570 feet above datum which means that Thirty-one Mile Lake would have to rise 40 feet, and Pemichangaw 18 feet. Owing to the enormous area of Thirty-one Mile Lake it would take five or six years before this lake would rise even to the level of Pemichangaw, that is 22 feet, and ten or twelve years before it reached the final level of 570 above datum. It is obvious that the scheme should be so laid out as to enable water to be brought forward to Ottawa as soon as the equduct and service reservoir can be completed, which can be effected in the following manner:—

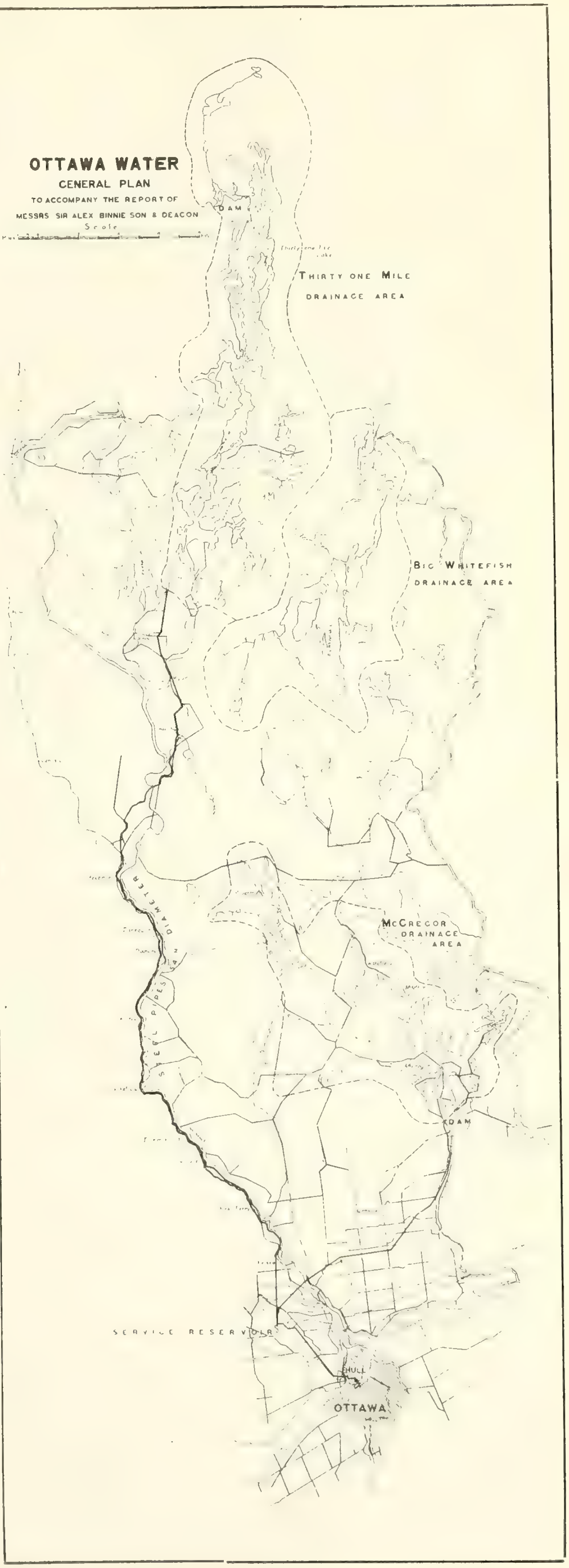
Pemichangaw and Long Lake have a total drainage area of about 41½ square miles and would yield on the basis of a run-off of 13.6 inches about 22½ million gallons per diem, or sufficient for the needs of the City for a good many years.

The level of Pemichangaw Lake varies between about 554 and 552 feet above datum, and the lake is separated by a narrow neck of land known as Point Comfort from Thirty-one Mile Lake which is about 30 feet lower in level. This neck of land acts as a natural barrier which retains water at the higher level in Pemichangaw, and is traversed by a narrow gorge through which the water is discharged into Thirty-one Mile Lake. This gorge is blocked by a wooden dam provided with sluices and the fall of water from one lake to the other is utilized for a sawmill. Water also finds its way into Thirty-one Mile Lake from Pemichangaw through debris overlying the rock filling the bottom of what no doubt was at one time a valley of discharge from one lake to the other. I was informed that there were underground fissures connecting the two lakes, and the measurements which have been taken this summer show that when the water level in Pemichangaw stood at 554 feet above datum the amount of water which got through this debris or surface fissures in the rock amounted to approximately 8,000,000 gallons per diem; but when the water level in the lake had fallen to 552 datum the discharge was very small indeed, showing that the water was really finding its way from one lake to the other through a comparatively shallow channel. Of course there may be some deep underground fissures which would be incapable of detection, but there is no doubt that any water lost by them is insignificant provided the present level of the lake is not materially altered. I should therefore propose as one of the first steps to be taken to open a trench across the old channel and fill this concrete so as to cut off the water now leaking away through the debris when the water level is raised to 554 feet above datum, and to make a water tight dam in lieu of the existing leaky dam which holds up the water for the mill. These works would enable the water to be retained in Pemichangaw Lake and the City could draw upon that lake as soon as the aqueduct was completed. The present water area of Pemichangaw is about 6 square miles and 5 feet in depth on that area would represent the total storage required for the first installment of 25,000,000 gallons per diem. Assuming that the minimum draw-off level was to be 549 feet above datum or 3 feet below the present level, the maximum level at which the water would overflow would be 554 feet above datum. Although in this way the storage required for the first installment would be provided it must always be borne in mind that Thirty-one Mile Lake will take years to be brought up to the level of Pemichangaw, and it must not be forgotten that on the basis of my figures the Pemichangaw area will not quite yield sufficient for the first installment of 25,000,000 gallons or as much as the aqueduct will carry, and the sooner Thirty-one Mile Lake is brought up in level the better.

The dam at the outlet of Mitchell's Lake should therefore be proceeded with as soon as the necessary arrangements could be made so that Thirty-one Mile Lake can be gradually raised to such a level as to flow towards Ottawa by means of the aqueduct. I have therefore included in the estimate for the supply of 25,000,000 gallons the cost of the dam at Mitchell's Lake, and also the necessary clearing to bring Thirty-one Mile Lake and Pemichangaw Lake to the level of 570 feet above datum when storage will be provided for the full yield of the drainage area or 81,000,000 gallons a day.

To bring the water of Pemichangaw into Long Lake from which lake the aqueduct would start, will necessitate constructing a tunnel through the height of land between the two lakes, a distance of about 3,000 feet, as already pointed out. This tunnel should be made about 7 feet internal diameter so as to permit of the whole available yield, namely, 81,000,000 gallons per diem being passed through into Long Lake without appreciable loss of head.

The best location for the invert of the tunnel would be about 6 feet below the present level of Pemichangaw or at


OTTAWA WATER
GENERAL PLAN
TO ACCOMPANY THE REPORT OF
MESSRS SIR ALEX BINNIE SON & DEACON
Scale
DAM
THIRTY ONE MILE DRAINAGE AREA
BIG WHITEFISH DRAINAGE AREA
STEEL PIPES 4 DIAMETER
McGREGOR DRAINAGE AREA
DAM
SERVICE RESERVOIR
HULL
OTTAWA

about 546 feet above datum, 24 feet below top water level when brought up to 570 feet above datum.

The tunnel would terminate at each end in covered shafts the water entering the shaft at the inlet end and leaving the shaft at the outlet end well below the water level of the respective lakes.

In this way there would be no danger of the water in the tunnel freezing even if the lakes were drawn down to the level of 549 feet above datum, which is the minimum draw-off level, during the construction of Mitchell's dam and during the period while the lakes are filling up to 570 feet above datum.

In order to enable the tunnel to be driven from an open face to obviate the necessity of pumping any water which may be met with, and also to facilitate the construction of the outlet works, it is proposed to draw down Long Lake during construction in the manner to be presently described.

Works at Long Lake

Long Lake varies in depth from about 20 feet to 50 feet, being shallow towards the north end and deep towards the south. This lake, like Pemichangaw, is formed by a natural barrier, and the water issuing from it passes over this barrier by means of a series of small falls and cascades to the valley below, dropping 50 or 60 feet in a short distance.

A short cutting through this barrier will therefore enable the water to be drawn down 20 or 30 feet without any difficulty.

The shores of the lake are steep and rocky but at times during and after windy weather the sediment in the bottom is stirred up by wave action. This action does not extend to any great depth probably not much below 10 feet. It is therefore proposed to remove the sediment, logs, etc., when the lake is drawn down so as to prevent similar action taking place in the future.

Outlet Works

These works would consist of a straining tower about 50 feet high, covered at the top and provided with copper gauze screens; the water entering the tower at a depth of 7 or 8 feet below the minimum water level of the lake and after passing through the screens leaving by means of a culvert through the natural barrier already referred to, to the commencement of the pipe. It is proposed to install a small water-driven turbine so as to work a pump for supplying high pressure water for washing the screens. The power for this turbine would be supplied by allowing water to pass from the lake to the valley below, the turbine being situated at the foot of the fall which has already been referred to. The screens would be made so that they can be lifted in rotation for cleaning purposes without interfering with the flow of water and the dirty water, after cleaning, would be discharged into the valley before the straining tower.

Description of Pipe

The top water level of the service reservoir which will presently be described, would be 445 feet above datum. The distance between the outlet and the service reservoir is about 235,000 feet and allowing for losses of head at the reservoir the hydraulic gradient would be approximately 1 in 1,960, and with this gradient a welded or lock-bar steel pipe, 54 inches in diameter, would deliver 25,000,000 gallons a day allowing for future encrustation. If rivetted steel pipes were used the internal friction is slightly greater on account of the rivet heads and the diameter of the pipe would be slightly larger to discharge the same quantity of water. The estimate has been based on approximate quotations received for 54-inch welded steel pipe, 7-16th of an inch in thickness. With soft water considerable encrustation may be anticipated, but seeing that the Thirty-one Mile Lake water contains about four and a half grains of lime per gallon it is probable that this may not take place to any appreciable extent. The Ottawa River water contains about two and a half grains per gallon and appears to have had very little effect on steel pipes which were laid many years ago without any protection by means of coating. It has been found that steel pipes are also liable to corrode from the outside if laid in saline or marshy ground unless special precautions are taken. The best protection in such cases is to surround the pipe with tarried hessian or jute, and provision has been made in the estimate for this precaution where the pipes would be located in swampy ground. To prevent freezing in winter the pipes should be laid so that the bottom would come a minimum of 8 or 9 feet below the surface of the ground, and the estimate has been got out on this assumption.

Service Reservoir

The function of this reservoir is two-fold:—

1. To provide against a water famine in the town should the water have to be cut off in the aqueduct to allow of repairs being executed.
2. To meet the daily fluctuations in demand as the water supplied to a town varies throughout the day, the maximum draught or peak load being nearly twice the average. A reserve must also be available in case of fire.

Supposing no service reservoir were provided it would be necessary to lay two pipes all the way from the source of supply in order to be able to shut off one line while the supply was kept up by the other. It is far more economical to lay out a gravity scheme of this nature so as to include a service reservoir of ample size than to lay a duplicate main when the aqueduct is long and a good site can be found for the reservoir at a suitable level. Fortunately a good site at a suitable level has been found where the water would be stored in a basin having a flat bottom and surrounded by hills. The bottom of the reservoir varies from about 410 to 416 feet above datum and by means of three small dams the water would be held up to a level of 545 feet above datum. The water area would be about 54 acres and one foot in depth would represent approximately 15,000,000 gallons. The probable variation in water level to meet the daily fluctuation in demand would therefore be less than one foot. The contents of the reservoir between the level of 420 and 445 feet above datum would amount to about 295,000,000 gallons and represents a reserve of about 12 days supply which is very ample when compared with what is allowed by other cities. The average number of days supplied in the service reservoir of the large towns in England is from three to four days reserve. The static pressure given by this reservoir would represent 118 pounds at the pumping station or 81 pounds at Parliament Hill, and is about the maximum pressure that the house fittings would stand in the lower parts of the City.

Pipes From the Service Reservoir to the City

These pipes should be designed so as to be able to discharge for short periods during the day a much larger quantity than the pipes from the source to the service reservoir for the reasons which have already been given. The maximum rate of consumption is taken at 110 gallons per head per diem and if unavoidable waste is added to this, say 40 gallons per head per diem, the total maximum rate of consumption would amount to 150 gallons per capita per diem. To this should be added the amount required for say 25 fire streams which would be equivalent to a rate of discharge of another 36 gallons per head per diem, so that the pipes should be designed so as to be capable of discharging 186 gallons per capita per diem as a peak load. On the basis of a population of 250,000 persons the above rate would represent a discharge of 46½ million gallons per diem. Two 51 inch pipes would deal with this peak load so that when the population increased to 250,000 persons the pressure would not fall below 110 pounds at the existing pumping station even should a serious fire occur during the period when the maximum demand was being made for water for domestic purposes.

I have directed considerable attention to the question of this river crossing and various routes have been investigated. I am emphatically of the opinion that the pipes should be carried over the various channels at this point on bridges, as if the pipes are carried over a bridge it is an easy matter to inspect and maintain them in good condition, but once they are laid in the river bottom it is a very different matter. Another method which is equally effective is to construct a tunnel under the river and to lay the pipes through this tunnel. I am adopting this latter method in the crossing of the River Dee on the aqueduct from Wales to Birkenhead and have considered the possibility of crossing under the Ottawa in the same manner. The rock, however, is full of joints and I should anticipate considerable difficulty owing to the amount of water which would be met with in driving the tunnel under the river, so I have come to the conclusion that it would be better to pass over and not under the river. There are four channels which would necessitate first,—a bridge about 300 feet long on the Hull side of the river, then a bridge 500 feet long over the main channel of the river, then two short spans, one of 80 and one of 120 feet, the latter crossing the tail race canal from the present pumping station.

For the present I confine myself to an aqueduct crossing only, the bridges being designed so as to interfere as little as posible with the existing surface of the ground and of sufficient strength to carry four 51-inch diameter pipes which would give a maximum discharge at the rate of 93,000,000 gallons per diem without material loss of head between the service reservoir and the City.

Summary Estimate

Having now considered the main features of the project it remains to give the estimate of the cost of the necessary works which is as follows:—

Head Works	
Dam at outlet of Mitchell's Lake to raise water surface to 570 feet	130,180
Clearing and burning area to be submerged	128,000
Tunnel between Pemichangaw and Long Lakes including shafts, etc.—3,000 lin. ft.	119,630
Outlet works at Long Lake—straining tower, etc.	43,660
Smaller works about lakes, including subsidiary dams at depressions in height of land, temporary works at Pemichangaw, lowering and clearing Long Lake, etc.	72,000
Aqueduct to Service Reservoir	
54 in. Steel Main 7-16 in. thick between outlet tower and service reservoir—235,000 lin. ft.	4,314,080
Bridge on Gatineau River	30,000
Various smaller stream crossings and culverts ...	110,000
Service Reservoir	
Dams	212,150
Clearing and stripping site	21,460
Inlet and outlet works	26,600
Aqueduct Service Reservoir to City	
51 in. steel main 7-16 in. thick between service reservoir and City—two lines of pipe each 32,000 lin. ft.	1,101,120
Various smaller stream crossings, culverts, etc. ..	20,000
Bridge across the Ottawa River	180,000
Total for Works	$6,508,880
Add 15 per cent. for engineering and contingencies	976,320
	$7,485,200
Land, Lakes, compensation and Wayleaves as per Mr. Gendron's estimate	500,000
Total estimate	$7,985,200

Road Builders' Convention at Philadelphia

Enterprising Arrangements

PLANS for the coming convention of the American Road Builders' Association at Philadelphia, Pa., December 9, 10, 11 and 12, which will be the tenth annual gathering of that organization, are being rapidly matured by the convention committee having the matter in charge.

Although the entire programme of the technical sessions has not been definitely decided upon, a general scheme for covering the various subjects to be considered has been prepared and many assignments of papers have been made. The matters to be discussed at the convention will be taken up under three general heads—organization, construction and maintenance. These will be further subdivided so as to cover every phase of road and street work.

A departure from the usual method of conducting the congress will be made this year by the holding of a popular session on Thursday evening. At this meeting, addresses will be made by prominent public men who have evinced an interest in highway betterment.

On Thursday afternoon the delegates will be taken on an inspection trip through the city. This will afford an excellent opportunity to view street improvements and other work of a like nature.

The local committee is making extensive plans for the entertainment of the delegates and the social features of the convention are being carefully arranged. One of these will be a theatre party for the A. R. B. A. members, the exhibitors and official delegates on Wednesday evening. Special provisions are also being made for the entertainment of the ladies attending the congress. An automobile ride around the city has been planned for them on Wednesday afternoon, and other entertainments will be provided.

Applications for space are being received in large numbers and the indications are that it will be necessary to accommodate some of the larger and heavier exhibits outside of the building. The number of spaces already assigned not only assures the success of the exhibition but also indicates that it will be one of the greatest displays of road-building machinery and materials ever made at a road congress. The officers of the association will be quartered at the Bellevue-Stratford Hotel. The sessions of the convention and congress and the exhibition of machinery, materials and methods, as well as place of registration of delegates, will be at the First Regiment Armory.

Personal Mention

Mr. S. H. Reynolds, at one time Assistant City Engineer of Winnipeg, has been appointed commissioner by the administration board of the Greater Winnipeg Water District. Mr. Reynolds is living in Victoria, B.C.

Mr. Yasuichiro Tomita, chief of the District Construction Department of the Imperial Government Railways of Tokyo, has been a visitor to Montreal. He is going round the world, and has been to Great Britain and several United States cities. His object in visiting Canada is to see the St. Lawrence bridge now in course of construction.

Mr. H. Grattan Tyrrel, bridge engineer, of Chicago, a graduate of the University of Toronto, gave an illustrated lecture on October 15th, before the Engineering Society of the Northwestern University on the subject of "Bridge Engineering." Mr. Tyrrell was formerly Chief Engineer for one of the Ohio bridge companies, and afterwards special engineer of bridges for the Harriman Railroads in the Western and Pacific States. He is the author of several books on bridge and structural engineering.

From the Saskatchewan Capital

Correspondence of the Contract Record

REGINA, Oct. 24th.—Building activity has been increasing of late with the easier money conditions now obtaining. The crop prospects have given a fillip to business generally and many important works are contemplated and under way. The outlook for the coming season was never better.

A matter that is receiving considerable attention at the hands of the city council at the present time is the question of better street lighting. For some time past the ratepayers have been agitating for increased street lighting and the city council recently decided to accede to the request. The standard pillar tungsten lighting system had numerous supporters, but the arc lighting was also favored. In order that the majority should rule, the city council held a conference with representative systems with regard to the class of lights to be installed. The cost of the tungsten system was not favored, and the selection lies between the high arc lamps and the inverted arcs.

Constructional view of the new Anglican College at Regina, now nearing completion.

The firm of Campbell, Wilson & Strathdee, with warehouses in several different western cities, have decided to erect a new warehouse in Regina, the present one having become inadequate. The new warehouse will have a frontage of 108 feet on Dewdney avenue and will be five storeys in height. No statement has been given out as to the estimated cost of this building.

The Emerson Brantingham Implement Company, with headquarters at Rockford, Illinois, have decided to move their Canadian headquarters office from Winnipeg to Regina. The Reeves Company. It is understood that large extensions will be necessary.

The Regina works committee has decided to further extend the sewerage system, so as to provide drainage for the low-lying land in the northeast section of the city and also to serve the abattoir. Several additional extensions of the company will occupy the premises formerly occupied by the sewer have been decided upon. One of them is to serve the new Wetmore school in the southeast section.

Reilly, Dawson, Hancock & Reilly, architects, Westman Chambers, Regina, have been awarded the contract to superintend the erection of Swift Current's latest and most up-to-date school. Twenty-six architects submitted plans. The plans accepted provide for twelve class-rooms, each to accommodate forty-two pupils; large departments for domestic science and manual training; an assembly hall 54 feet by 52 feet, with large stage and dressing room; and all necessary smaller rooms, such as principal's office, library, rest room, teachers' room, etc. The cost is estimated at $120,000.

The plans and specifications for the proposed station, to cost $134,000, are being prepared.

E. A. Brown, Regina, has invented a tube bender for conduit work. This is his third invention, the other two appliances for conduit work having been sold to a firm in London, Eng.

The Broad Street subway is now nearing completion, only the paving of the roadway now remaining.

New Filtration Plant

In order to deal with the matter of sewage disposal in the city of Regina in a more efficient manner, three new percolating filters were recently added to the existing plant. These filters are of particular interest as they constitute the first disposal plant that has ever been designed with the special purpose of overcoming the climatic difficulties which are met with in the Regina district.

Each of the three filters which comprise the plant is of circular plan, 110 feet in diameter at the base and 100 feet in diameter at the surface. The depth is 8 feet in every case. The floors are of concrete, and the containing walls are also of the same material, suitably reinforced. The former slope to effluent channels at an incline of 6 per cent., collecting galleries being also provided. The roofs or covers of the filters are carried on superstructures of rolled steel I-beams, which are carried by short steel columns bolted to concrete piers in the containing walls. These covers afford excellent protection from the weather in winter, and are so arranged that they can be easily removed and the filters opened up during suitable weather. Each filter is fitted with automatic revolving sprinklers of the Adam's Cresset type. The filter-

Head Office Building of the Royal Northwest Mounted Police, Regina, completed recently.

ing media is of broken stone of one-inch and two-inch to three-inch section, one uniform size to each filter.

The filters are designed to deal with 150 imperial gallons of effluent per 24 hours per cubic yard, dry weather flow, but are also capable of dealing with three times this amount during storm periods, and once they are matured they will give a non-putrescible effluent that will meet all the requirements of the provincial board of health. After leaving the filters the effluent is conducted into a main effluent pipe large enough to accommodate the outflow of nine additional filters.

Mainly Constructional

The News in Brief—From Coast to Coast

The next important step in the construction of the C. N. R. will be the double-tracking of the system from Winnipeg to Fort Frances, according to Sir Donald Mann.

Work is now in full swing on the new Twenty-fifth street bridge across the South Saskatchewan river at Saskatoon. This bridge will cost $400,000, and will take over a year to build.

Arrangements have been made to manufacture in Montreal the Van Noorden standard fireproof windows, the agents for which are the Fire Prevention Company of Canada, Limited, Montreal.

The people of Essex County will vote January 1st on a scheme to spend $1,000,000 on good roads. The road plan would give the county a system of concrete roads completely encircling it and encompassing all the small towns.

For the year ended 31st March last, the P. Lyall & Sons Construction Company, Limited, earned $258,697, of which bond interest absorbed $63,298, preferred dividend $106,166, and reserve account $40,000, the surplus being $49,231.

The Port Weller Land Company, Limited, has been incorporated with a capital of $40,000 to carry on business as general contractors and builders, with head office at Toronto. The provisional directors are W. R. Wadsworth and D. R. Leask, of Toronto.

At a meeting of the Montreal Board of Trade, a joint fire prevention committee presented a report recommending a higher standard of building construction in Montreal and the appointment of a board of inspectors to see that the city by-laws were better observed.

The Windsor Sand and Gravel Company, Limited, has been incorporated with a capital of $40,000 to manufacture and deal in contractors and builders' supplies, with head office at Windsor. The provisional directors are H. A. White and F. W. Barclay, both of Windsor.

The Niagara Brick and Tile Company, Limited, has been incorporated with a capital of $100,000 to erect buildings and deal in building material, with head office at Niagara Falls. The provisional directors are F. W. Griffiths, H. F. Upper and W. B. Masters, all of Niagara Falls.

Canadian Bitumastic Enamels Company, Limited, has been incorporated with a capital of $40,000, to carry on business as a general contracting and building company, with head office at Toronto. The provisional directors are A. W. Holmested and A. B. Mortimer, Toronto.

Plans have been completed by Mr. A. M. Jeffries, city architect of Edmonton, for a combined fire hall and police station, costing $350,000, to be erected at Elizabeth street and Fraser avenue. It is announced that work on the structure will proceed early next season. The structure will be of five storeys and full basement and will have dimensions of 100 x 165 feet, the materials of construction being brick, steel, concrete and stone.

The Confederation Contracting Company, Limited, has made application for incorporation. The provisional directors include Messrs. M. J. O'Brien, of Renfrew; Hugh Doheny, Quinton and Robinson, of Toronto and Montreal. The new enterprise is capitalized at $2,000,000. The company will operate this winter as sub-contractors on the Welland canal.

Actual work on the Shoal Lake water scheme of the city of Winnipeg was started on its way last week at a meeting of the administration board of the Greater Winnipeg Water district, when Commissioner S. H. Reynolds and Chief Engineer W. G. Chace were formally instructed to proceed immediately with the necessary surveys and the preparation of plans and specifications, and such other information as is required to carry out the scheme.

The contract for the construction of the Canadian Northern Pacific from Patricia Bay to the entrance of the Songhees Reserve terminals at Victoria, which will complete the rail and ferry service between Vancouver and the provincial capital has been let to J. Macdonald and the Littleton-Bruce-Elsback Company, the work embracing a joint contract. Construction has already commenced, and the work will be rushed to completion as fast as possible.

The work of grading the Canadian Pacific Railway extension from Victoria as far as Union Bay will be finished by the end of November, according to Clarence Hoard, who has a contract for the grading of the section between Courtenay and Union Bay. Men are busy on the concrete abutments and piers ready for the steel bridges which will be erected by the railroad company. There are two of these spans on this section, and the contractors will be ready for their erection at the end of the present month.

The Government has decided to utilise the Champlain Market site in Quebec for the erection of a station for the Transcontinental Railway, for which plans are now being prepared. The Champlain Market site was selected by the late Government for the main terminal of the Transcontinental Railway in Quebec, but was subsequently found to be unsuited for use in this way and arrangements were made for another location. It has now been decided to build a station on the original site, to be used in conjunction with the main terminal and to take care of river traffic. The scheme is also understood to include a belt line around the city.

Within a few months Prince Rupert, B.C., the Pacific coast terminus of the Grand Trunk Pacific, will have its first permanent hotel building. This will be "The Premier," now well advanced in construction, and which is being completed as quickly as possible. The building is the first modern fireproof brick, steel and concrete hotel erected north of Vancouver in either Canadian or American territory. The building has a frontage of 50 feet on Second avenue and 100 feet on Sixth street, and overlooks the Grand Trunk Pacific reserve, which is to be laid out in a park. The hotel is five storeys high and contains eighty bedrooms, with hot and cold running water in every room, the majority of the rooms being furnished with private baths. The cost of the building is $100,000.

At a recent meeting of the bondholders of the Canada Iron Corporation, a resolution was passed authorizing the liquidators to borrow up to $250,000 to carry on the business and giving the money so borrowed priority over the bonds. Arrangements have been made to carry on the foundry business, which comprises plants at Fort William, St. Thomas, Hamilton, Three Rivers and Londonderry. The foundry business of the corporation amounted to about $4,000,000 last year and while it has been affected by liquidating proceedings and may not be as great this year, it is yet sufficiently large to form the basis for the reorganization which is now being worked upon by the English bondholders. It is not proposed to operate the furnace and mine departments of the corporation during the period of liquidation. Some of the plants are already closed and the rest will probably be closed shortly.

A sewage disposal plant costing between two and three million dollars, to be located on the west bank of the Don River, near the second dam and about half a mile north of the Don Valley Brick Works, is proposed by the municipal engineers who have been preparing a scheme of sewers for the northern part of Toronto. It is planned that all sewage originating in the districts of North Ontario, Cedervale and Moore Park shall pass through this purification plant, where the solid matter is to be separated from the clear water, the latter being turned into the stream of the Don, and the former undergoing a treatment which will convert it into fertilizer, which the city will sell to farmers. The whole North Toronto sewer scheme involves an outlay estimated at more than six million dollars, including the disposal plant. It is planned to lay trunk sewers, eight and nine feet in diameter, through the several ravines in the northern parts of the city.

The Imperial Steel & Iron Company, Limited, who will erect a plant in Prince Albert for the manufacture of horse shoes, plates for bridge iron and corrugated sheeting, announce that, when completed, the works will employ between 600 and 700 men and will be capable of handling 4,000 tons of iron a month. The site covers 31 acres and the buildings number eleven in all, as follows: a jobbing sheet and plate mill, containing galvanizing and paint shops, 80 x 208 feet; a horse shoe factory, run by electricity; the finishing mill, 260 x 80 feet, containing a 9-inch and 12-inch finishing mill, a Belgian train and two waste heat boilers for steam generating. The combination muck bar and bar crane is located in a building 200 x 80 feet, which will also house 250 horse-power waste heat boilers and a 700 horse-power engine. The scrap shearing and preparing department is provided with seven pairs of shears. The power house is divided into two portions, half of the building to be used as a boiler house with 1,000 horse-power boilers, and the other half for electric generators. The other buildings comprise warehouses and storing sheds.

Increased Harbour Facilities for St. John, N.B.

The announcement by Mr. Bosworth that two new C. P. R. liners, larger than the present Empresses, will be completed next year and run direct to St. John in winter, emphasizes the plea for a policy of more rapid harbour development at this port. Sir Thomas Shaughnessy told a St. John delegation last week that the facilities at St. John were inadequate at the present time, and that they could not be increased too rapidly because of the increasing business which must come to St. John in winter over the rails of the C. P. R. The city council and board of trade will now bend all their energies to the effort of getting wharves and warehouses built more rapidly. Two new steamship berths will be completed by the winter of 1914-15, but more will be required, and, as the task of building them is considerable, it will be necessary to make a beginning next year. This relates to the facilities at West St. John. There must also be a large expenditure to provide harbour facilities at East St. John for the traffic of the Grand Trunk Pacific and, it is hoped, the Canadian Northern Railway. The present dispute about the terminal port of the mail steamships has brought out in the strongest manner the fact that increased harbour accommodation is urgently needed both at St. John and Halifax, if Canadian trade in winter is to be carried to an increasing extent through Canadian channels. St. John is now asking that ten additional steamship berths be provided as soon as possible.

Ontario Architects' Association

The following officers were elected at the closing session of the Ontario Architects' Association at Grimsby:—Mr C. H. Acton Bond, Toronto, president; Mr. D. H. Moore, Toronto, first vice-president; Mr. L. S. Taylor, Ottawa, second vice-president; Mr. J. P. Hayes, Toronto, treasurer; Mr F. E. Delfry, Toronto, registrar.

The following were elected as members of the council: Mr. C. P. Meredith, Ottawa; Messrs. J. F. Wegman, C. A. Acton Bond, J. P. Haynes, H. E. Moore, C. H. C. Wright, Toronto; Mr. L. Jennings Taylor, Ottawa; Mr. J. Power, Kingston; Mr. A. E. Nicholson, St. Catharines; Mr. W. W. Stewart, Hamilton; Mr. W. R. Greig, Toronto; Mr. C. E. Langley, Toronto.

Railway and Bridge Builders' Convention at Montreal

Mr. A. E. Killam, of Moncton, N.B., the head of the American Railway and Bridge Association, presided at the 23rd annual convention held in the Windsor Hotel, Montreal, last week. Mr. Killam is known as a foremost Canadian bridge builder, and was responsible for many structures in the Maritime Provinces, retiring from the Intercolonial Railway last May.

In connection with the convention, there was an exhibition of many appliances, building and other materials in a room adjacent to the meeting hall.

The first day was spent in welcoming the members and the presentation of reports. Mr. William McNab, principal assistant engineer of the Grand Trunk Railway, welcomed the members. He spoke of the tie between the Americans and Canadians who were engaged in the same branch of work, and the beneficial influences of such a gathering, referring to the technical and social elements entering into the proceedings. It was appropriate that the convention should take place in Montreal, where in the immediate vicinity were two noteworthy bridge structures. One was the Victoria bridge; the other the C. P. R. bridge which had just been rebuilt.

Mr. McLean, past president, spoke upon the lines of the mutual interests of Canada and the United States.

The president, who also welcomed the members to Montreal, referred to the history of the organization and its last meeting on Canadian soil, in Quebec, speaking of the value of the technical reports and expressing his satisfaction at the work of the various committees.

Reports on the Preservation of Timber, temporary structures for supporting tracks during the construction of permanent work, snow ferries, cattle guards, sewers and drains, and the construction and maintenance of track scales were presented and discussed during two days of the convention.

Several social functions were included in the programme. The members also visited the St. Lawrence Bridge Company's plant.

"The Illumination of Construction Work" is the title of Bulletin B 3269, issued by the Canadian General Electric Company, Limited, Toronto. The contractor engaged in operations where time is an essential factor cannot fail to find some interest in the matter of the efficient lighting of his work after hours. The G.-E. Type W. Flame Arc Lamp of the above company is especially adapted for all classes of construction work. It has a remarkable brilliancy of from 1,500 to 2,000 candle-power. It is economical in operation, simple in construction and burns from one hundred to one hundred and twenty hours without attention.

Rapid Concrete Paving Work at Toronto

Started July 24th, 1913. Finished July 31st, 1913.

An interesting piece of concrete paving was carried through this season by the Godson Contracting Company of Toronto. Shortly before Toronto's big Exhibition opened it was decided by the city authorities to pave the roadways of the Exhibition Park. It became a question of quick work. The Godson Contracting Company were entrusted with the undertaking. To give an idea of the rapid manner in which the work was carried out it is interesting to learn that 14,378 square yards of 5-in. concrete were laid in five days and seven hours (days of nine hours). Two one-bag Austin Cube Street Machines were used, with spreading arm and bucket to mix and lay the above quantity of concrete in the time mentioned. The average day's work of each machine was 1,178 square yards per day of nine hours.

For a number of years the Godson Contracting Company have been firm believers in the Cube principle of mixing. Five years ago they purchased probably the first Cube Mixer to be used in the city of Toronto. This machine also helped to pave the Exhibition roadways, putting down 1,178 square yards of concrete in a day of nine hours.

Godson Contracting Company, of Toronto, using two Austin Cube Street Machines.

The Cube differs from any other batch type of mixer by reason of the fact that the mixing action is done entirely by the cubical-shaped drum. Scientifically, there can be no mix as perfect; practically, there can be no mix as rapid. By doing away with the blades and paddles the entire batch flows from the plane of the cube with nothing to retard the free movement of the mixed mass. The special street machine does away with wheeling in barrows from the discharge end of the mixer. A bucket is provided which runs in and out on a long arm and takes the entire contents of the batch, discharging at any point within a radius of 40 feet. The machine is also propelled under its own power and the engine made reversible, so that it moves backward or forward equally well.

The city of Toronto have also two Austin Cube Machines: one two-bag traction machine, without spreading arm, which was used last year by the Railways and Bridges Department, and this year by the Roadway Department; and a one-bag machine, with spreading arm and bucket, which has been used this year by the Roadway Department with excellent results.

The city of Montreal (not to be outdone by Toronto) purchased two Cube Street Machines this year. Our information is that these machines have proven most satisfactory.

The Highways Department of the Provincial Government of Ontario, to further the cause of the Good Roads Movement, have also purchased an Austin Cube Street Machine, which is now working at Aylmer, Ont.

Messrs. Lecky & Collis, Limited, of Napanee, Ont., and 335A Craig Street West, Montreal, are the Canadian agents for these machines. It is due to their efforts that so many Cube Mixers can be seen in operation in all the principal cities where the forward movement in concrete road-making has taken firm hold. Upon application they will furnish a little booklet, "The Science of Mixing Concrete," which is of much interest to the roadway engineer and contractor.

Labor-Saving Sidewalk Tools

The Abram Cement Tool Company of Windsor, Ont., whose "Wrist Motion" sidewalk tools are well and favorably known to many readers of this journal, have favored us with the latest copy of their catalogue. This publication is illuminating in regard to the possibilities of the high grade of work—executed with more speed and less labor—which the company's finishing tools hold forth. Each of the company's tools is equipped with a long handle and a special patented device that gives the tool the correct motion and enables the workman to stand erect at the work. The catalogue illustrates very forcibly the manner in which this "wrist motion" device automatically gives the blade the proper position. The company manufacture the complete line of tools required in sidewalk construction. The fact that these tools have been adopted by many of the leading contracting firms in Canada and the States is a sufficient argument in favor of the investigation of their merits by every contractor. We have seen these tools in operation a number of times and have no hesitation in commending their labor-saving principles and general construction.

Paving the Midway, Exhibition Grounds, in record time.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Chapleau Twp., Ont.

Extension to water mains, cost $5,000, planned. Clerk, T. J. Godfrey, Chapleau, Ont. Ratepayers will vote on bylaw November 3rd.

Metcalf Twp., Ont.

Tile drain planned by Twp. Council. Tenders received by Clerk, Geo. Lewis, Kerwood, Ont., until Nov 3rd, for construction of the O'Neil Drain.

Regina, Sask.

Plank sidewalks planned by City Council. City Engineer, F. McArthur. Tenders received until Oct. 31st, for construction of 34,200 lin. ft. of 4 ft. plank sidewalk, 10 16 ft. crossings, 54 24 ft. crossings, supply of 273,650 ft. B.M. of 2 in. x 8 in., 10 in. or 12 in., 12 ft or 16 ft. long, 20,400 ft. B.M. of 3 in. x 8 in., 16 ft. long, 75,800 ft. B.M. of 2 in. x 6 in., 16 ft. long, 31,000 ft. B.M. of 2 in. x 4 in. 12 ft. or 16 ft. long, 8,400 ft. B.M. of 4 in. x 4 in. 14 ft. long, 400 lbs. of 5 in. nails, 6,700 lbs. of 4 in. nails, 2,000 lbs. of 3½ in. nails.

Sudbury, Ont.

Extension to water mains, cost $5,000, planned by the Town Council. Clerk, George Elliott. Ratepayers will vote on by-law November 3rd.

Toronto, Ont.

Sewers. Argyle street storm sewer, Section No. 1. Balmy, Lyonde, Spruce Hill Rd., Willow, McLean, Pine, Cedar, Bloor W., Regal Rd., Balsam and Springmount. Board of Control, Mayor H. C. Hocken. Plans at Works Dept. Tenders close November 4th.

Sidewalks planned by the Board of Control. Mayor, H. C. Hocken. Plans at Works Dept. Tenders close November 4th. Concrete walks on Alton, Bain, Carlaw, Evelyn, Lee and Windeat.

Pavements planned by Board of Control. Board of Control. Mayor, H. C. Hocken. Plans at Works Dept. Tenders close November 4th. Asphalt on Coady, Cruickshank, Edith, Hickson, Standish and Theodore. Asphalt concrete on Givens. Bitulithic on Peel and Russell Hill Road. Brick block on Derby Lane. Grading Wheeler avenue. Concrete curbing on Derby Lane.

Tenders received until Nov. 18th for brass and bronze castings, brass work for house services, cast iron pipes, hydrants, iron valve and stop cock boxes, lead pipe, special castings, stop valves. Specifications, etc., at office of Works Dept., City Hall. Board of Control. Mayor, H. C. Hocken.

Tenders received until Nov. 18th for supplying and laying an 84 in. steel conduit from the Pure Water Reservoir on Toronto Island to the South Tunnel. Plans, etc., at Room 10, Works Dept., City Hall. Board of Control. Mayor, H. C. Hocken.

Vancouver, B.C.

Waterworks. Clerk, Wm. McQueen. Tenders received by Clerk till Oct. 29th, 1913, for construction of Point Grey Partnership Pipe Line.

Windsor, Ont.

Concrete and asphalt pavements on Howard, Lewis, Elm, Brant and Sandwich streets, planned by City Council. Mayor, Henry Clay. Clerk, Stephen Lusted. Engineer, Edward Brian. General contractor, Thos. Chick.

Winnipeg, Man.

Local improvements planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Avenue. Sewers on: Waverley St. from Colquhoun Ave. to 376 ft. S. Water mains: Burrows Ave. from McPhillips St. to 200 ft. W. Ethelbert St. from Wolseley to Ida Ave. Kent St. from McCalman to Talbot Ave. Wolfe St. from Windsor to Johnson Ave. Spruce St. from 50 ft. north of Lawn to 200 ft. north of Wolever Ave. Asphalt No. 2 pavement: McMillan Ave. from Lilac to Stafford St. Tenders received by Board until Oct. 31st. Specifications at office of Engineer.

CONTRACTS AWARDED

Edmonton, Alta.

Asphalt plant, cost $5,000, 29th. Owners, architects and builders, Worswick Paving Co., 1053 23rd St. Two storeys, 27 x 53, frame construction, concrete foundation. Foundations in.

Regina, Sask.

Pumping unit planned by City Council. City commissioner, L. A. Thornton. City Engineer, F. McArthur. It has been recommended that contract be awarded to Canada Fairbanks Morse Co., Ltd., 300 Princess St., Winnipeg, Man.

Toronto, Ont.

Sewer, cost $32,093, planned by Board of Control. Mayor, H. C. Hocken. Commissioner of Works, R. C. Harris. General contractors, Gawne Contracting Co. Danforth Ave. storm overflow sewer system Section No. 2.

Water mains planned by Weston Town Council. Clerk, J. H. Taylor. General contractor, G. B. Moogk, Main St. 600 ft. of 4 in. pipe on St. Johns Road and 2 in. pipe on Conron Place.

Sewers. Beech Ave. and Belsize Drive, M. H. Murphy, 84 Wells Hill Ave., Dominion St., $4,757, Danforth Ave., $68,800, Morrison Ave, $17,487, to Godson Contracting Co., Manning Chambers. Earlscourt Drainage System, $47,800, to John Maguire, 196 Spadina Road. Board of Control. Mayor, H. C. Hocken.

Pavements, etc. Asphalt on Sorauren, to Contracting & Paving Co., Confed. Life Bldg., $9,423; St. Nicholas St. and Russett Ave., to Godson Contracting Co., Manning Chmbrs., $4,150. Concrete pavement on Lane N. of Queen from Sherbourne, to Riverdale Concrete Paving Co., grading on Rockwell and Silverthorn Ave., to Britnell Contracting Co., Dupont St., $2,775. Board of Control. Mayor, H. C. Hocken.

Railroads, Bridges and Wharves

Cobourg, Ont.

C. L. O. & W. Ry. has been authorized to construct bridge across Sinclair St. by means of an undercrossing at mileage 20.6 and rescinding order No. 19093, April 19, 1913.

Central pier planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders to be called for shortly.

London, Ont.

Breakwater, cost $25,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. By-law for West London breakwater passed Oct. 22nd.

Hamilton Twp., Ont.

C. L. O. & W. Ry. has been authorized to construct bridge No. 21.29 across road allowance between lots 22 and 23, Con. A.

Huntsville, Ont.

G. T. R. has been authorized to reconstruct bridge No. 202 to carry its railway over Big East River, mileage 150.75 on 12th District near Huntsville.

Province of Quebec

C. N. O. Ry. Co. has approved location of station at Isle Jesus, Parish Ste. Dorothee, lot No. 85, mileage 38.95, Hawkesbury East, Co. Laval, Que.

Remi, Que.

C. N. O. Ry. has approved location of station at Remi, Parish Ste. Genevieve, Co. Jacques Cartier.

Seal Cove, N.S.

Breakwater planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders to be called for shortly.

CONTRACTS AWARDED

Brandon, Man.

Car barns, cost $20,000, 1st St. General contractors, The Beaver Constr. Co., Ltd., Princess Ave. Engineer, J. Antonisen. Tenders to be called shortly for 9 street cars.

Fredericton, N.B.

Freight sheds, cost $13,000 to $15,000. Lynch property, planned by Dom. Govt. Dept. of Railways & Canals (I. C. R.). Sec., L. K. Jones, Ottawa. General contractors, Messrs. McLaggan, McBean & Bell, Fredericton. Engineer, F. Condon. 300 ft. long, concrete foundation, frame construction, steam heating.

Malbaie, Que.

Pier, cost $43,000, planned by Dom. Govt. Dept. of Public Works. Sec., R.

C. Desrochers, Ottawa. General contractor, Jno. Burns, Malbaie.

Pictou County, N.S.
Culverts planned by Prov. Govt. Dept. of Public Works. Commr., Hon. E. H. Armstrong, Halifax. Contracts awarded to Jas. O. Kerr, Eureka, Pictou County, $708; F. W. Fordes, Trenton, Pictou County, $9,093; L. & W. Gammon, River John, Pictou County, $1,200.

Rougemont, Que.
Station for Montreal & Southern Counties Rly., Canadian Express Bldg., Montreal. General contractors, A. F. Byers & Co., 340 Unoversity, Montreal. Excavating started.

Salmon River, N.B.
Wharf, cost $10,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Island Dredging Co., Salmon River.

Tring Jct., Que.
Railroad station, cost $6,000, for Quebec Central Rly. Co. Manager, J. H. Walsh, Sherbrooke. Supt. of Rly. Bldgs., Jno. Farquhar, Sherbrooke. Architect, H. G. James, Whiting Block, Sherbrooke. General contractor, W. C. Goff, Thetford Mines. Two storeys, 72 x 26.

Public Buildings, Churches, Schools, etc.

Edmonton, Alta.
Masonic temple contemplated. Architects, Magoon & MacDonald, Tegler Bldg. Eight storeys, 1st 2-storeys granite construction, upper storeys of mat glazed terra cotta. Contracts will not be let this year.

Grosse Isle, Que.
Hospital, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Foundation, J. B. Gallibois, Montmagny. Four storeys, 200 x 75.

Montreal, Que.
Church alterations, cost $25,000, for Congregation of St. Henry, St. James St., St. Henry. Architect, L. J. T. Decarie, New Birks Bldg., Montreal. Tenders to be called in January. Work to start April, 1914. Bouchard stone construction.

Recreation building, planned by Town Council of Verdun. Mayor, Mr. Allan, Verdun. Police Dept. have urged the need of this building, to include skating rink, toboggan slides, reading rooms and a billiard hall.

Theatre, cost $20,000, Park Ave. and Bernard, contemplated for Mr. Joly, 1205 St. Viateur, W. Architect, Z. Trudel, 238 St. Andre. Specifications not made yet, description of building later.

Hospital, contemplated by Royal Edward Institute. Sec., Dr. E. S. Harding, Belmont St., Montreal. Plans will be prepared.

Church, for St. Michael's Parish. Father L. Callaghan, Montreal. Site to be chosen by Archbishop of Montreal, and plans will be prepared.

Theatre contemplated for Mr. J. J. Shubert, c/o The Shubert Co., New York, N.Y., have secured an option of 24,000 ft. of land near the Princess Theatre, close to St. Catherine St. W.

Ottawa, Ont.
Government buildings, cost $5,000,000. Chief architect, D. Ewart. Time for reception of designs in the first competition for erection of Departmental and Court buildings is extended until April 2nd, 1914. Dom. Govt., Dept. Public Works, Secretary, R. C. Desrochers, Ottawa.

Church, cost $10,000, West End, contemplated for St. Francis D'Assiso Church. Father Superior, Hintonburg, Ottawa. Stone construction, seating capacity 700. Plans in progress.

Port Nelson, Man. (Hudsons Bay)
Grain elevator, planned by Dom. Govt. Dept. of Trade and Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa. Tenders received until Nov. 5th. Capacity 1,500,000 bushels.

Regina, Sask.
Shelter, Alexandra Park, planned by City Council. City Commissioner, L. A. Thornton. Supt. of Parks and Boulevards Dept., J. Vanshe. 1½-storeys, brick construction, concrete foundation, metal tile roofing, concrete floors, galvanized ridge, 6 lavatories.

St. George East, Que.
Post office fittings. Tenders received by Sec., R. C. Desrochers, Ottawa., Dom. Govt. Dept. of Public Works, until Nov. 4th. Plans, etc., at office of Chas. Chapais, Post Office Quebec, Postmaster, St. George East, and at Dept., Ottawa.

St. John, N.B.
Alterations to St. John's Church, Carleton, planned. Rector, Rev. G. A. Kuhring, 80 Coburg St. Architect, Garnet Wilson, 50 Princess St. Re-arranging pulpit and chancel.

Tenders addressed to C. Johnston, Deputy Minister Marine and Fisheries, Ottawa, will be received until Dec. 20th for the construction of a wooden lighthouse and dwelling (combined), a boat house and oil shed, at St. Martin's Head, Bay of Fundy, St. John County. Plans, specifications, etc., at this Dept., Ottawa and St. John, and Post Offices St. Martin's, Salmon River, Rothesay and Sussex.

Toronto, Ont.
Church, contemplated for Jane street Methodists. Pastor, Rev. Gilbert Agar, 64 Indian Grove Ave. Plans in progress.

Church, cost $30,000, planned for Royce Ave. Presbyterians. Treas., Jos. Reid, 9 Hugo Ave. Work may start in spring 1914. Presbytery have given permission to raise above sum.

Church, planned for Roman Catholic Episcopal Corporation. Architect, Bishop Neil McNeil, Wellesley Place. Site purchased at 223 Jarvis St. for Syrian Roman Catholic Church.

Addition to Ryerson school planned by Board of Education. Tenders received by Sec.-Treas., W. C. Wilkinson, City Hall, until Oct. 31st, for several trades. Plans at office of Supt. of Bldgs.

Tenders received by Sec.-Treas., W. C. Wilkinson, City Hall, Board of Education, until Oct. 31st, for Fresh Air Class Room on roof of Hestor How School.

Tenders received by Board of Education, Sec.-Treas., W. C. Wilkinson, City Hall, until Oct. 31st, for heating, plumbing and electric wiring at Shirley, Parkdale and Kimberly schools.

Winnipeg, Man.
Church contemplated for St. Michaels and All Angels Anglican Congregation. Pastor, Rev. G. H. Broughall, 611 Mulvey Ave., looking for a site for new church and plans will be prepared.

Wingham, Ont.
Hall and hose tower, cost $3,200, contemplated by the Town Council. Architect to be selected. Further information from Ald. Geo. Spotton. White brick and frame construction, shingle roofing, electric lighting, maple floors.

CONTRACTS AWARDED

Berlin, Ont.
Alterations to theatre, King St., for Joe Zuber. Architect, G. M. Miller, 59 Yonge St., Toronto. General contractor, Adam Dengis, Berlin. Plumbing, J. Hainsworth, 14 Foundry St. N.

Theatre, cost $25,000, College and King Sts., for L. Longo. Architect, C. Cowan. Carpenter, B. Becker, 45 Courtland Ave. Preston Metal Co. supplying the metal for ceiling.

Edmonton, Alta.
Fire hall, cost $15,000, Inglewood. Mayor, Mr. Short, Civic Offices. Clerk, C. Cox. Architect, A. Jeffers. General contractors, Nesbitt & Miller, Hart Blk. Two storeys, 45 x 80, brick construction, felt and gravel roofing. Foundations in.

Fredericton, N.B.
Central fire station, cost $21,550, King St., planned by City Council. Clerk, J. W. McCready. Architect, Kenneth M. Campbell. General contractor, Fred J. Ryan, Regent St. Three storeys, 91 ft. 6 in. x 31, freestone and tapestry, brick construction, felt and gravel roofing.

Frelighsburg, Que.
Convent, cost $12,000, planned for Rev. Sisters Precious Blood. General contractor, F. Robert. Three storeys, 55 ft. x 65 ft. Foundations in.

Hampton, N.B.
Post office, cost $10,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, H. H. Mott, 13 Germain St., St. John. General contractors, British American Construction Co., Ltd., Prince Wm. St., St. John.

Montreal, Que.
Fire and police station, cost $85,000, Bois de Boulogne, planned by Board of Commissioners. Secretary, L. N. Senecal. Architects, C. A. Reeves, 58 St. James St. General contractors, Picard & Balin, care architects.

Alterations and addition to Y. W. C. A., cost $25,000, 25 St. Famille St. Architects, Finley & Gagnon, New Birks Bldg., Montreal. General contractor, M. J. Aquin, Lachine. Heating, plumbing and electrical, Thos. O'Connell, Murray St., Montreal. Four storeys, 25 x 80.

Interior fittings, Postal Station "B," cost $6,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, The J. T. Schell Co., Alexandria, Ont.

Port Arthur, Ont.
Armouries, cost $200,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Tharle, Brown & Stewart, 309 Park Ave. Heating and plumbing, J. W. Barnes & Co. Electrical, Mahon Bros.

P. O. fittings, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, J. T. Schell Co., Alexandria, Ont.

Regina, Sask.
Lodge Hall, Retallach, for Sons of

England Institute. Sec.-Treas., E. Peachey, P. O. Box 1175. General contractor, Roger Edwards, 1667 Athol St. Brick and stone construction, stone foundation. Foundations in.

Sault aux Recollet, Que.
Club and gymnasium, cost $25,000, for Club Canadien Champetre, Sault aux Recollet. Architect, C. A. Reeves, 58 St. James St., Montreal. General contractor, C. Durocher, Montreal East. Concrete foundation, waterproofing, frame construction.

St. John, N.B.
Sunday school building, cost $40,000, for Germain St. United Baptist Church. Pastor, F. S. Porter, Queen St. Architect, F. Neil Brodie, 42 Princess street. General contractor, R. A. Corbett, Douglas Ave.

Observatory, for Dom. Govt. Meteorological Service. Architect, Garnet Wilson, 50 Princess St. General contractors, British American Constr. Co., Ltd., Prince William St.

Toronto, Ont.
Sunday School, cost $4,000, 64 Fern Ave., for Church of Christ. Pastor, Rev. Albert Brown, 26 Lynd Ave. Architect, J. F. Brown, Board of Trade Bldg. General contractor, J. Stewart, 627 Crawford St. One storey, 24 x 60, brick and steel construction, brick foundation.

Theatre and store, cost $15,000, Queen St. E. Owner and general contractor, A. B. Webster, 55 Spruce Hill Rd. Work not started, owner will sub-let. Three storeys, 40 x 110, steel and brick construction, brick foundation, felt and gravel roofing.

Theatre, cost $10,000, 780-2 Yonge St., for A. G. Robertson (in trust), 58 Colborne. Architect, N. G. Beggs, 12 Cosgrave Bldg. General contractors, Orr Bros., Queen St. E. Three storeys, 24 x 112, steel and brick construction, brick foundation, felt and gravel roofing, lime and sand plastering, metal lath, mosaic tiling, store fronts and fixtures, seating.

Winnipeg, Man.
Conservatory unit, cost $15,000, Assiniboine Park, planned by Park Board, 229 Chambers of Commerce. Sec., J. H. Blackwood. Architects and general contractors, Lord & Burnham, New York. To be erected in spring 1914.

Theatre, Market St., for Patterson & Cass, Canada Bldg. Architect, G. W. Northwood, Northern Crown Bank Bldg. General contractors and plastering, J. McDermott & Co., Canada Bldg. Electrical, Cowan & Levy, Portage Ave. Walls up.

Business Buildings and Industrial Plants

Berlin, Ont.
Twine factory, Galemans Place, contemplated for Arthur Forster, 123 King St. E. Site purchased and plans will be prepared.

Calgary, Alta.
Stores, cost $5,000, 17th Ave., for P. J. Crohan. Architects, Laing & Smith, 210 Beveridge Bldg. One storey, 50 x 70, hollow tile construction, concrete foundation, Carey roofing. Plans in progress.

Cowansville, Que.
Extension to carriage repair shop contemplated for Soules & Christie. One-storey, 50 x 21, concrete foundation. Plans will be prepared.

Fredericton, N.B.
Stores and apartments, cost $8,000, York and Charlotte Sts., for Geo. Cronkhill, Lower Southampton, York County. Plans in progress.

Guelph, Ont.
The Merchants Bank are contemplating making extensive alterations in near future.

London East, Ont.
Two stores, cost $25,000, for W. Heughan, 1004 Dundas St. Architects, Watt & Blackwell, Bank of Toronto Bldg. Two storeys, 60 x 75, tapestry brick construction, concrete and stone foundation, felt and gravel roofing, plate glass, store fronts and fixtures. Tenders in. Specifications at office of Architect.

Montreal, Que.
Addition to factory for Alaska Feather & Down Co., Ltd., 412 St. Ambroise St. Plans in progress.

Two stores and flats, cost $5,000, Papineau, planned for Mathien Beauchamp, 875 Delorimier. Three storeys, 30 x 60, concrete foundation, felt and gravel roofing. Permit issued.

Two stores and flats, cost $5,000, Beaubien, for Jos. E. Lamoureux, 449 Beaubien. Three storeys, 25 x 60, concrete foundation, felt and gravel roofing. Plans ready.

Garage and office building contemplated for the Automobile Club of Canada. Pres., H. Pillow. Sec., Geo. A. McNamee, 10 Cathcart. Architect will probably be chosen this month as money question is about settled.

Store and flats, cost $4,000, St. Hubert, for Dr. M. O. Belanger, 3452 St. Hubert. Three storeys, 28 x 52, concrete foundation, felt and gravel roofing. Plans ready.

Additions planned by Windsor Hotel Co. Manager, Hutchison, Windsor Hotel, Windsor St. Architect, H. C. Stone, 84 St. Francois Xavier St. Extensive improvements to interior of hotel are contemplated, including new marble work in bar and general overhauling.

Ottawa, Ont.
Store and residence, cost $6,000, Munroe, for J. Dathell, 38 Munroe St. Brick veneer construction, stone foundation. Plans in progress.

Niagara Falls, Ont.
Remodelling bank building, Erie Ave. and Park Street, for Royal Bank, local manager, E. R. Dewart. Address C. J. Doran.

Regina, Sask.
Warehouse, Cornwall and Dewdney, planned for Campbell, Wilson & Strathdell. Excavating, Andrew Gettselig, 1930 Halifax.

Warehouse and repair shop, for Emerson, Brantingham Implement Co., Headquarters, Rockford, Ill., U.S.A. President, C. S. Brantingham. Vice-President, E. T. Talbott. Plans in progress.

Store and flat, cost $10,000, Glengary. Tenders received by Architects, Atchison & Adams, till Oct. 30th. Two storeys, 38 x 60, brick veneer construction, brick foundation.

Winnipeg, Man.
The City Creamery, Pritchard Ave., are adding one-storey to pressent building, one storey, 24 x 40, brick construction, felt and gravel roofing,. maple floors Cost $15,000.

CONTRACTS AWARDED

Amherst, N.S.
Store, cost $5,000, Fifth Ave., for Chapman & Canfield. Architect, J. L. Allen. Carpentry, roofing and plastering, Jos. Baxter. Plumbing not let. 2-storeys, 35 x 65, comp. paper, birch floors, lime and sand plaster, plate glass store fronts and fixtures.

Berlin, Ont.
Shoe factory, cost $26,000, Kaiser St., for Gourlay & Fogelberg, Kaiser Street, Berlin. Architects and general contractors, Secord & Sons, Brantford. Walls up.

Fredericton, N.B.
Cold storage, cost $3,000, York and King, for Searle & Lamson, York St. General contractor, Chas. Hall. One storey, 55 x 25, stone foundation, stock brick construction.

Montreal, Que.
Factory alterations, cost $10,000, rear 50 Parthenais, for Dominion Oil Cloth Co., Ltd., 1192 St. Catherine E. Architects, Hutchison, Wood & Miller, Royal Insurance Bldg., Montreal. General contractor, Eusebe Meloche, 304 Eighth Ave., Rosemount. One storey addition, 54 x 116, felt and gravel roofing.

Niagara Falls, Ont.
Store and flats, cost $4,500, Queen St. Owner and general contractor, Roland Reed, Queen St. Two storeys, 50 x 21. Walls up.

Stanstead, Que.
Addition to business block planned for General Contractor, Jas. A. Gilmore. Two storeys, 39 x 32. Foundations in.

Toronto, Ont.
Store and residence, cost $4,000, Gerrard and Leslie. Owner and general contractor, J. J. Bradley, 1 Richard Ave. Two storeys, 20 x 56, brick and steel construction, concrete foundation, felt and gravel roofing. Store fronts and fixtures, plate glass.

Windsor, Ont.
Stores and offices, cost $40,000, Jasper Ave., for Captain Allen Palmer, England. Architects, Magoon & MacDonald, Tegler Bldg. General contractors, mason, carpenter, roofing and plastering, Dunlop Constr. Co., 204 Hart Block. Steel, Dominion Iron Works, Winnipeg. Electrical, Burnham Frith Electric Co., Rice and McDougall Ave. Three storeys, 53 x 95, brick construction, concrete foundation, felt and gravel roofing. Foundations started.

Offices and police quarters, cost $13,000, Grierson, for Royal North-West Mounted Police. Architect, A. M. Calderon, 259 Jasper Ave. General contractor, W. C. McArthur, 523 Sinclair St.

Stores and offices, cost $65,000, for Runnalls & Nickels, 140 Jasper Ave. Architect, E. C. Hopkins, 32 Jasper Ave. W. General contractors, Read, MacDonald & Brewster, Tegler Block. Painting, Chapman & Turner, Anderson Blk. Heating and plumbing, Kelly & Kakett, 120 Norwood Blvd. Elec., Penny & Newman. Three storeys, 53 x 100.

Hensall, Ont.
Repairs to business block, cost $10,000. Owner and architect, R. Bell. General

contractor, Alfred Taylor. Repairs to buildings recently damaged by fire. White brick construction, concrete and stone foundation, felt and gravel roofing, store fronts and fixtures.

Kingston, Ont.
Extension to stables, cost $18,600, planned by Dom. Govt. Dept. Militia & Defence. Deputy Minister, Eugene Fiset, Ottawa. General contractors, Campbell & Wright, Kingston. Piles and concrete foundation, red brick construction.

Magog, Que.
Business block planned for Miss A. Clomptors. Private plans prepared. Steel, MacKinnon, Holmes & Co., Sherbrooke. Two storeys, 30 x 0.

Montreal, Que.
Garage, cost $5,000, 240 Drummond, rear, for R. B. Angus, 240 Drummond St. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, mason and carpenter, Reid, McGregor & Reid, 14 Guy Block. Steel, Structural Steel Co., New Birks Bldg. Other contracts to be given out shortly.

Stores and flats, cost $20,000, Outremont (Bernard St.), for Mr. Bessette, 97 St. James St., Montreal. Architect, J. A. Ouellette, 250 Amherst St., Montreal. Carpenter, Davis & Morisett, c/o Architect.

Garage, cost $15,000, St. Timothee, for P. T. Legare Ltd., 180 Amherst. General contractor, Henri Leoasseur, 116 Amherst. Two storeys, 42 x 75, concrete foundation, stone, steel and brick construction, felt and gravel roofing. Permit issued.

Ottawa, Ont.
Garage for W. J. Kennedy, 52 Cooper St. General contractor, I. B. Younghusband, 6 Spruce. Solid brick construction, concrete foundation.

Alterations to store and apartments, cost $4,000, Slater St., for C. B. Taggart, 341 McLeod. Architect, W. Herbert George, Castle Bldg., Queen St. Mason, T. C. James, 140 Flora St. Plumbing, J. R. McLennan, 240 Bank street.

Regina, Sask.
Addition to hotel, cost $12,000, S. Railway, for Palmer House, Ltd., S. Railway and Broad Sts. General contractors, McKay Construction Co., 1818 Scarth St. Two storeys, brick construction. Foundations in.

Warehouse, Dewdney and Cornwall, for Campbell, Wilson & Strathdale. Contractors for foundation Frid Lewis & Co., Ltd., Somerset Bldg., Winnipeg.

Stable, cost $23,900, Albert, planned by City Council (Dr. M. R. Bow, M.H.O.). Architect, R. W. Allen, City Engineer's Office. General contractors, Frid Lewis & Co., Ltd., 901 Somerset Bldg., Winnipeg. Two storeys, stone, brick and frame construction, corrugated iron roofing. Foundations in.

Addition to warehouse for Regina Plumbing & Heating Co., Ltd., Hamilton St. Architects, Storey & Van Egmond. General contractors, Minkley & Traub.

Stanbridge East, Que.
Tannery extension. Owners and general contractors, G. W. Sadler & Co. 100 x 64, concrete foundation, frame, fireproof and galvanized iron construction, asbestos roofing. Foundations in.

Sarnia, Ont.
Factory, cost $150,000, for Perfection Stove Co. Mech. Supt., Thos. Montgomery, 276 Brock St. General contractors, Imperial Oil Co. Will manufacture oil stoves and enamel ware. Three buildings, 100 x 200 each, brick, steel and glass construction. Day labor.

Waterloo, Ont.
Two stores, cost $12,000, King St. Owner, architect and general contractor, L. Wettlaufer, Sebringville. Two stys., 40 x 70, red pressed brick construction, concrete and stone foundation, 6 store fronts and fixtures. Excavating done.

Windsor, Ont.
Office building, cost $30,000, Quellette, for A. T. Currah. Architect, J. C. Pennington. Carpenter, Geo. Haugh. Three storeys, 52 x 90. Foundations in.

Winnipeg, Man.
Stores, cost $18,000, Broadway, for Dr. Peatman, 304 Main St. Architect, J. D. Atchison, Trust & Loan Bldg. General contractors, Lailey & Co., 367 Maryland. One storey, 66 x 75, brick construction, felt and gravel roofing. Excavating started.

Alterations to office building planned for Travellers Bldg. Assn. Sec.-Treas., F. J. C. Cox. Architects and builders, Jas. McDiarmid & Co., Canada Bldg. Alterations to club, billiard room and kitchen, also alterations to various offices.

Residences

London, Ont.
Apartment house, cost $15,000, Horton, for A. Hartmann, 300 Dundas St. Architects, McBride & Gilbert, Edge Block. Work may start this fall. Three stys., 50 x 80, white brick construction, concrete and stone foundation. Plans in progress.

Residence, cost $7,000, planned for Fred Henderson, c/o Robinson, Little Co. Tenders received by Architect, W. G. Murray, Dom. Savings Bldg. 2½-stys., 36 x 35, red brick construction, concrete foundation, slate or asbestos roofing.

Montreal, Que.
Six flats, cost $6,000, St. Ferdinand, for Louis Latulippe, 1098 St. Antoine. Three storeys, 40 x 35, concrete foundation, felt and gravel roofing. Plans in progress.

Flats, cost $9,000, rear 727-29 Pine Ave. W., for M. D. Baldwin, 194 Park Ave. Three storeys, 52 x 38, concrete foundation, pressed brick construction, felt and gravel and corrugated iron roofing. Plans ready.

13 flats, cost $6,000, 582 De Gaspe, for J. E. Lalonde, 1918 St. Denis. Three storeys, 25 x 48, stone foundation, felt and gravel roofing. Plans ready.

Residences, cost $8,000, Outremont (Querbes St.). Owner and architect, A. Lamontagne, 2561 Esplanade St., Montreal. Three storeys, 40 x 72, stone foundation, Columbus brick construction, felt and gravel roofing. Plans ready.

Flats, cost $8,000, for J. Foley, Pickering Ave. Architect, T. L. Hollingsworth, c/o Owner. Two storeys, concrete foundation, brick construction, felt and gravel roofing. Plans drawn.

Three flats, cost $6,000, St. Zotique, for Alf. Lalande, 288 St. Dominique. Three storeys, 25 x 61, concrete foundation, felt and gravel roofing. Plans ready.

Flats, cost $11,000, for J. White, Indian Road. 2½-storeys, concrete foundation, brick construction, felt and gravel roofing. Plans drawn.

Eight flats, cost $7,000, Chateaubriand, for Nap. D. Legar, 3361 St. Hubert. Three storeys, 50 x 51, concrete foundation, felt and gravel roofing. Plans ready.

Residence, cost $15,000, Outremont (Blvd. St. Joseph), for W. Duquette, 2668 Park Ave. Architect, A. St. Louis, 80 St. Gabriel St. Brick, T. Rochon, 1891 Esplanade. Tenders for all other trades are in but contracts will not be awarded for a couple of weeks. Two storeys, 36 x 57. Excavating started.

Regina, Sask.
Residence, cost $20,000, for F. Chapman Clemensha, Albert St. Plans ready.

Toronto, Ont.
Residence, cost $5,000, Riverdale, for F. W. J. Hill, 55 Woolfrey. Two stys., 22 x 52, brick construction, stone foundation, felt and gravel roofing. Plans drawn.

Apartments, cost $9,000, Gormaly, for B. A. Cumpston, care architect, S. B. Coons, 512 Temple Bldg. Two storeys, 36 x 56, brick construction, stone foundation, felt and gravel roofing. Plans drawn.

Residence, cost $9,000, Warren Road, planned for R. T. Brown, 197 St. George St. Architect, J. Hunt Stanford, Bloor and Ossington, is now ready to receive tenders on all trades except masonry and carpentry. Foundation in. 2½ storeys, 24 x 38, slate, felt and gravel roofing.

Winnipeg, Man.
Residence, cost $4,000, Sherburn. Owner and architect, W. W. Fleming, 97 Canora. 2½-storeys, 24 x 28, frame construction, stone foundation. Plans ready.

Residence, cost $5,500, Balfour Ave. Owner and architect, R. C. Mitchell, 312 Florence Ave. Two storeys, 28 x 28, frame construction, stone foundation. Plans ready.

Three residences, cost $12,000, Sherburn, for R. Robson, 284 Simcoe. Two storeys, 25 x 28, frame construction, stone foundation. Excavating started.

CONTRACTS AWARDED

Edmonton, Alta.
Residence, cost $8,000, for Mrs. Miller. Architect, W. D. Cromarty, 21 Dominion Block. General contractors, McSporran & Co., 715 2nd St. 2½-storeys, 44 x 46, frame construction, concrete foundation. Foundations started.

London, Ont.
Residence, cost $4,500, St. James St., for O. R. Moore, 478 Waterloo street. Architect, J. M. Moore, 425½ Richmond St. General contractor, J. Putherbough, 1002 Wellington. Two storeys, red pressed brick construction, stone and concrete foundation.

Residence, cost $15,000, for Henry Pocock, c/o London Concrete Machinery Co. Architects, Watt & Blackwell, Bank of Toronto Bldg. Mason, J. Evans & Sons, 905 Queens Ave. Other contracts will be let shortly. Two storeys, tapestry brick construction, concrete foundation. Excavating done.

Montreal, Que.
Residences, cost $16,000, Westmount (Mountain St.), for Ryan Tetley, 78 Crescent St., Montreal. Architects, Tetley & Dogerth, 78 Crescent St. General

(Continued on page 72)

Tenders and For Sale Department

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Lindsay, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913,** for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Lindsay, Ont., and at this department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47381. 43-44

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Lakefield, Ont.," will be received until 4 p.m. on **Wednesday, November 5, 1913,** for the construction of a Public Building at Lakefield, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Lakefield, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—49240. 43-44

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year 1914 for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,
Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada,
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine. 42-45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Orillia, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913,** for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Orillia, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C.DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47491. 43-44

FOR SALE OR RENT

One ten ton Ruston Proctor Steam Roller, good as new.

RIGBY & ANDREWS,
43 St. Catharines, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Port Hope, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913,** for the construction of Harbour Improvements at Port Hope, Durham County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Port Hope, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47820. 43 44

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Department of Railways and Canals, Canada

Trent Canal

Notice to Contractors

Nassau Dam

Sealed tenders, addressed to the undersigned and marked "Tender for Nassau Dam, Trent Canal," will be received at this office until 12 o'clock noon on **Friday, October 31st, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of Superintending Engineer, Trent Canal, Peterborough, Ont.

An accepted bank cheque for the sum of $10,000.00 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,

Ottawa, 13th October, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—49189. 43-44

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Pile Protection Work, at Rainy River, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913**, for the construction of a Pile Protection Work, at Rainy River, Thunder Bay and Rainy River District, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of F. Y. Harcourt, Esq., District Engineer, Port Arthur, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.; and on application to the Postmaster at Fort Frances, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48052. 43-44

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 4th, 1913**, for the construction of the following sewers:—

Balmy Ave. from Birch Ave. to East End;
Lyonde Cres. from Balsam Ave. to Beech Ave.;
Spruce Hill Ro. from Queen St. to Pine Ave.;
Willow Ave. from Queen St. to Balsam Ave.;

McLean Ave. from Queen St. to North End;
Pine Ave. from Balsam Ave. to Birch Ave.;
Cedar Ave. from Beech Ave. to Willow Ave.;
Bloor St. from old city limits to W. S. Dundas;
Regal Road from Northcliffe Blvd. to Springmount Ave.;

Argyle St. Storm Overflow Sewer, Sec. No. 1, from Shaw St. to Gladstone Ave.;

Balsam Road from Balsam Ave. to West End;
Division No. 2 West Toronto, Contract No. 3;
Outlet from Keele St. and Uttley Park to Quebec and Annette via Uttley Park, Hillsview Ave., Medland Cres., Humberside Ave. and Quebec Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, October 15th, 1913. 44

TENDERS

—for—

Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, November 18th, 1913, for

Brass and Bronze Castings.
Brass Work for House Services.
Cast Iron Pipes.
Hydrants.
Iron Valve and Stop Cock Boxes.
Lead Pipe.
Special Castings.
Stop Valves.

Specification and tender form for any of the foregoing may be obtained upon application to the head office of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by city by-law, must be complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control
City Hall, Toronto, Oct. 21, 1913. 44

Notice to Contractors

Temporary Bridge

Sealed tenders addressed to the Board of Control will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Tuesday, November 4th, 1913**, for the erection of a temporary bridge over the Rideau River north of the present Billings Bridge.

Any tender received after the above stated date will be declared informal.

Specifications and full particulars may be obtained on application at the City Engineer's office, City Hall, Ottawa.

The Corporation does not bind itself to accept the lowest or any tender.

ARCHIBALD CURRIE,
City Engineer.
Ottawa, October 23rd, 1913. 44

Proposed Government Buildings Ottawa, Ont.

Extention of Time

Notice is hereby given that the time for the reception of designs in the first competition for the erection of Departmental and Courts Buildings, is extended for three months to **Thursday, April 2nd, 1914.**

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
—49657. Ottawa, October 23, 1913. 44-45

Sealed tenders addressed to the undersigned and endorsed "Tender for Construction of Wharfs at Victoria Harbour, B.C.," will be received at this office until 4 p.m., on **Tuesday, December 9, 1913**, for the construction of Wharfs at Victoria Harbour, B.C.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' offices at New Westminster, B.C., Victoria, B.C., Confederation Life Building, Toronto, Ont., Post Office Building, Montreal, P.Q., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 27, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45197. 44-45

Notice to Contractors

Intercepting Sewer

Sealed tenders addressed to the Chairman of the Board of Control will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Thursday, November 6th, 1913**, for the construction of the West End Intercepting sewer.

Any tender received after the above stated date will be declared informal.

Specifications and full particulars may be obtained on application at the City Engineer's office, City Hall, Ottawa.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.
Ottawa, October 27th, 1913. 44

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour and River Improvements in the Mission River, Fort William, Ont.," will be received at this office until 4 p.m., on **Friday, November 21, 1913**, for the construction of the Harbour and River Improvements.

Plans, specification and forms of contract can be seen and forms of tender obtained at this Department and at the office of W. P. Merrick, Esq., District Engineer, Fort William, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. L. Michaud, Esq., District Engineer, Post Office, Montreal, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 22, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46879. 44-45

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Residences

(Continued from page 73)

contractor, H. Strang, 4550 St. Catherine. Two storeys, 57 x 51, concrete foundation, brick construction, felt and gravel roofing.

Residence, cost $6,975, St. Lambert (Edison Ave.), for I. S. Inness. General contractors, Lording & Campbell. Carpenter not awarded, St. Lambert. Concrete foundation, frame and plastic brick construction.

Flats, cost $7,500, St. Lambert (Notre Dame Ave.), for S. David, Longueuil. General contractor, A. Gravel, St. Denis Ave., St. Lambert. Concrete foundation, encased brick construction, felt and gravel roofing. Excavating done.

Three flats, cost $9,000, Delorimier. Owner and general contractor, J. A. Duval, 1701 St. Lawrence. Architect, Z Trudel, 238 St. Andre. Work done by day labor. Three storeys, 25 x 105, concrete foundation, brick construction, felt and gravel and corrugated iron roofing.

Four flats, cost $6,000, Belgrave. Owner and general contractor, J. R. Lefebvre, 246 St. Antoine. Work done by day labor. Two storeys, 25 x 60, concrete foundation, felt and gravel roofing. Excavating done.

Flats, cost $25,000. Owner and general contractor, L. E.Kimpton, Birch Ave., St. Lambert. Concrete foundation, brick construction, felt and gravel roofing.

Flats, cost $7,000, St. Lambert. Owner and general contractor, J. K. Duncan, Notre Dame Ave., St. Lambert. Work done by day labor. Concrete foundation, frame and plastic brick construction, felt and gravel roofing. Foundations in.

Flats, cost $7,500, Outremont (Outremont Ave.). Owner and general contractor, Jos. Lecavalier, 1165 De St. Valier, Montreal. Work done by day labor. Three storeys, 28 x 75, stone foundation, brick construction, felt and gravel roofing.

24 tenements, cost $30,000, Notre Dame Des Grace (Western Ave.), for G. N. Clarmont, 97 St. James St., Montreal. Architect, J. A. Ouellette, 250 Amherst St., Montreal. Brick, M. Caille, 250 Amherst St., Montreal. Foundations in.

Ten flats, cost $5,000, 29 Forsythe, for Jos. Trudeau, Viauville. General contractor, Moise Trudeau, Fifth Ave., Viauville. Three storeys, 50 x 46, concrete foundation, felt and gravel roofing. Permit issued.

Four flats, cost $11,000, Belgrave Ave., for Isaac Collins, 207 Ash Ave. Architect and general contractor, P. Williams, Nicolet St. Two storeys, 50 x 60, concrete foundation, felt and gravel roofing. Permit issued.

Four flats, cost $10,000, Prudhomme, for Jno. Meyers, 158 Hillside ave. General contractor, Fred Jackson, 335 Hibernia. Two storeys, 40 x 86, concrete foundation, felt and gravel roofing. Permit issued.

Three flats, cost $5,000, Madison Ave. Owner and general contractor, Jas. H. Smith, 1825 Esplanade. Architect, Chas. Bernier, St. James St. Work done by day labor. Three storeys, 25 x 42, concrete foundation, felt and gravel roofing.

Eight flats, cost $7,500, Cartier. Owner and general contractor, Alb. Brouillette, 191 Marquette. Work done by day labor. Three storeys, 42 x 42, concrete foundation, felt and gravel roofing.

Six flats, cost $15,000, 2013-15 Mance, for Christie McFarland, 2040 Esplanade. Architects and general contractors, E. Shaw & Son, Esplanade Ave. Work done by day labor. Three storeys, 42 x 85, concrete foundation, brick construction, felt and gravel and corrugated iron roofing.

Residence, cost $28,000, for O. Limoges, 479 Papineau Ave. Architect, Jo Sawyer, 407 Guy St. General contractors, A. & D. Boileau, 343 Durocher St. Three storeys, 43 x 74, concrete foundation, stone and brick construction, felt and gravel roofing. Excavating done.

Residence, cost $6,000, Ballantyne ave., for Mrs. McRae, "The Mansions," Guy and St. Luke. Architects, Benoit & Girard, St. Catherine and Bleury streets. General contractors, Montreal West Contracting Co., Montreal West. Two stys., 27 x 31, concrete foundation, encased brick construction.

Montreal West, Que.

Residence, cost $6,000, Ballantyne Ave., for F. McLaren, St. Alexis St., Montreal. Architects and general contractors, Peden & McLaren, 20 St. Alexis St., Montreal. Brick construction. Foundations in.

Ottawa, Ont.

Residence, cost $7,000, Monkland, for E. I. Shuttleworth, 24 Euclid Ave. Architect, A. L. Weeks, Sparks St. General contractors, masonry and carpentry, Shuttleworth & Black, Journal Building, Queen St. Plastering and painting tenders to be called later. Electrical not let. Excavating done.

Residence, cost $6,000, Delaware Ave., for E. S. MacPhail, 127 Cartier. Architect, W. Herbert George, Castle B'dg., Queen St. Carpenter, I. Villeneuve. Painting, J. Store, 404 Bank St. Heating and plumbing, Coldrey & Chapman, 348 Rideau St. Foundations in.

Residence, cost $8,000, Monkland. Owner, architect and general contractor, Richard Hooper, 14 Monkland Ave. 2½-storeys, 30 x 36, brick veneer construction, stone foundation. Excavating started.

Port Arthur, Ont.

50 residences, cost $50,000, Algoma and Central, for The Canadian Resources & Development Co. Manager, Mr Lloyd Owen. Work done by day labor. One storey, 25 x 28, frame construction. 12 of these houses are completed. A wooden toboggan slide to cost $1,000, will be erected on Company's property.

Quebec, Que.

Residence, cost $6,500, 56 Claire Fontaine, for Mrs. B. T. Gaudry, 69-71 4th ave., Limoilou. General contractor, Delphis Roy, 79 Claire Fontaine. Other trades not yet awarded. Three storeys, 25 x 28, concrete foundation, frame and Scotch brick construction, felt and gravel roofing. Lime and sand plaster.

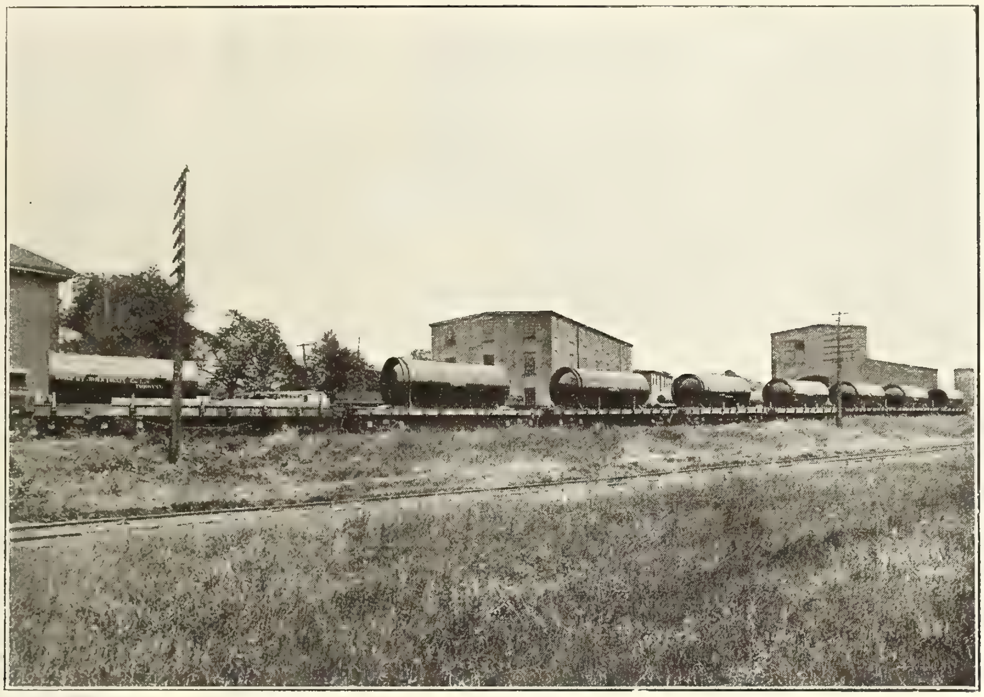
Residence, cost $4,500, 12 Durochers, for Wilbrod Devaresne, 10 Durochers. General contractors, mason and plaster, Jos. Villeneuve & Son, 299 P. Edouard. Other contracts not yet awarded. Three storeys and basement, 29 ft. 8 in. x 32, stone foundation, red and Scotch brick construction. Excavating started.

Regina, Sask.

Addition to apartments, cost $9,000, for Victoria Court Apartment Co., Victoria and Relattack St. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg. General contractors, McKay Construc-

The John Inglis Company
Limited

Engineers and Boilermakers



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If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

tion Co., 1818 Scarth St. Brick construction, felt and gravel roofing. Foundations in.

St. Johns, Que.

Residence, cost $5,000. Owner and general contractor, Mr. Paradis, St. John, Que. Architect, L. J. T. Decarie, New Birks Bldg. Work done by day labor. Concrete foundation, brick construction, felt and gravel roofing.

Toronto, Ont.

One detached residence, cost $3,800, Annette St., for J. A. Duffin, 1676 Dundas St. General contractor, H. S. Chapple, 239 Evelyn, will sublet. Two storeys, 20 x 38, brick construction, stone foundation.

One detached residence, cost $7,000, Foxbar Road, for Mrs. Geo. Acheson, 56 St. Clair Ave. W. General contractor, Chas. Parker, 17 Boswell Ave. 2½-stys.. 24 x 33, brick construction, stone foundation.

10 attached residences, cost $22,000, Beverley and Grange. Owner and general contractor, Simon Robinowitz, 12 Henry St. Architect, Benj. Brown, 218½ Queen St. W. Mason and carpentry, day labor. Owner will sub-let plastering, painting, heating, plumbing and electric. 2½-storeys, 160 x 42, brick construction and foundation, slate, felt and gravel roofing.

One detached residence, cost $5,000, 317 Seaton St. Owner and general contractor, H. G. Baggs 395 Roxton Road Will sublet plastering, painting heating, plumbing and electrical. 2½-storeys, 22 x 40, brick construction and foundation, slate roofing.

One detached residence, cost $4,800, Oakwood. Owners and general contractors, Shaw Bros., 501 Manning Ave. 2½-storeys, 22 x 36, brick construction, stone foundation.

One pair residences, cost $8,000, 101-3 Balmoral. Owner and general contractor, G. V. Burgess, 105 Balmoral Ave., superintends construction, will sublet. Work not started. Two storeys, 42 x 48, brick construction and foundation.

One detached residence, cost $5,000, Wells Hill Road. Owner and general contractor, J. W. Brown, 229 Christie St. Will sublet. 2½-storeys, 20 x 38, brick construction, stone foundation.

Residence, cost $5,500, Indian Rd., for Salvation Army, 20 Albert St. General contractor, R. E. Awde, 1 Abbott Ave. 2½-storeys, 22 x 44, brick construction, stone foundation.

Four pairs residences, cost $28,000, Orchard View Ave. Owner and general contractor, L. C. Sheppard, 17 Adelaide St. E. Regular staff employed. Work not started. 2½-storeys, 36 x 40, brick construction and foundation, shingle, felt and gravel roofing.

One detached residence, cost $4,000, Howard Park Ave. Owner and general contractor, H. M. Bennett, 57 Concord. Two storeys, 30 x 32, brick construction, stone foundation. Excavating done.

Winnipeg, Man.

Two residences, cost $8,000, Fleet Ave. Owner and builder, J. Stoller, 562 Pritchard. Two storeys, 20 x 28, frame construction, stone foundation, shingle roofing. Owner to construct 8 more houses in spring.

Apartment house, cost $45,000, McMillan. Owner, architect and builder, W. W. Cross, 54 Yale Ave. Three storeys, 104 x 70, pressed brick construction, concrete foundation, felt and gravel roofing. Plans drawn.

Apartment house, cost $20,000, Westminster Ave. Owner, architect and builder, H. A. Walley, 811 Somerset Block. Three storeys, 38 x 39, pressed brick construction, concrete foundation.

Walkerville, Ont.

Residence, cost $14,000, Kildare Road, for Wm. Grant, c/o Parke, Davis & Co., Architects, McFarlane, Maul & Lantz, Wayne Bank Bldg., Detroit, Mich. Carpenter, Alfred Mapes, Walkerville. Two storeys, 58 x 54.

Welland, Ont.

46 residences, cost $1,500 each, planned. Owner, architect and builder, Robert E. Hysert. Homes for employees of the Empire Cotton Mills. Two storeys, brick and frame construction, cement foundation.

Power Plants, Electricity and Telephones

Brantford, Ont.

The Dominion Power & Transmission Co., Supt. Geo. E. Waller, Hamilton, are considering plan to develop 2,500 h.p. at Moohawk Lake.

Hamilton, Ont.

The Dominion Power & Transmission Co., Supt. Geo. E. Waller, plan a steam plant to be erected to generate 15,000 horsepower.

Kingsville, Ont.

Electric light plant, cost $7,000, for Edison Electric Light Co. General contractors, The Albrecht Co., Detroit, Mich. White brick construction, concrete foundation. Excavating done.

London, Ont.

Power house equipment, York St., for London Electric Light Co. Engineer, C. S. Spicer, 12 Adelaide St. E., Toronto. Dynamos, Corliss engines, etc., required. Specifications, etc., at office of Engineer.

Ottawa, Ont.

Standards and lamps, Bank, required by City Council, Electrical Department. Engineer, Supt. J. Brown. "White Way" system contemplated between Gladstone avenue and Bank St. Bridge, a distance of two miles, standards spaced approx. every 75 feet.

Souris, Man.

Electric light plant, cost $4,000, planned by Town Council. Sec-treas., J. W. Breakey. Town Engineer, Percy C. Smith. General contractors, Accumulator Lighting Co., Ltd., 259 Isabel Street, Winnipeg. Storage battery systems, ornamental light clusters.

South Bolton, Que.

M. Houldsworth contemplates putting steam power plant in his mill to supplement the water power.

Winnipeg, Man.

Power house, cost $158,000, Broadway, planned by Prov. Govt. of Manitoba. Prov. Architect, V. W. Horwood, 261 Fort St. General contractors, National Constr. Co., Donalda Bldg. Ground is being cleared.

Miscellaneous

St. John, N.B.

City Council has voted money for gasoline pumping engine, motor chemical and hose cart for fire apparatus. Commr. Public Safety, H. McLellan.

Business Notes

Kingston, Ont.

Laundry building of Kingston Penitentiary, burned. Loss $10,000.

Midland, Ont.

Sawmill boiler house, of Manley Chew, completely destroyed by explosion. Brick building, 130 x 40, 4 boilers.

Montreal, Que.

School, Bernard St., burned. Loss $7,000. Owned by R. C. Board of School Commrs., c/o U. Lafontaine, Com. Academy, 85 St. Catherine W. Covered by insurance.

St. Antaine R. Richelieu, Que.

Roman Catholic Church burned. Loss $100,000, partly covered by insurance. Will rebuild.

St. Denis R. Richelieu, Que.

Bakery and residence of Jos. Mathieu, burned. Loss $5,500, partly covered by insurance. Will rebuild.

St. Hilaire, Que.

Roman Catholic Church burned. Loss $40,000, covered by insurance. Will be rebuilt.

Sarnia, Ont.

School, Brock and Devine streets, burned. Loss $6,000. Seven rooms. Will be rebuilt.

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220 King Street West - TORONTO

Geo. M. Miller & Co.

Architects

Toronto General Trust Building TORONTO

Power & Son,

Architects and Building Surveyors

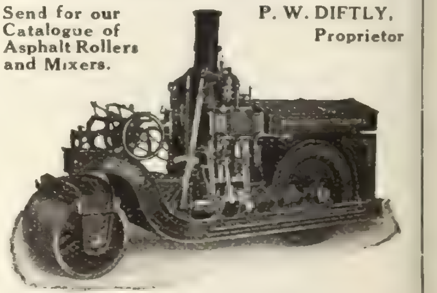
Merchants Bank Chambers,

Kingston, Canada

ERIE MACHINE SHOPS

Send for our Catalogue of Asphalt Rollers and Mixers.

P. W. DIFTLY, Proprietor



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1303 Peach Street, - Erie, Pa.

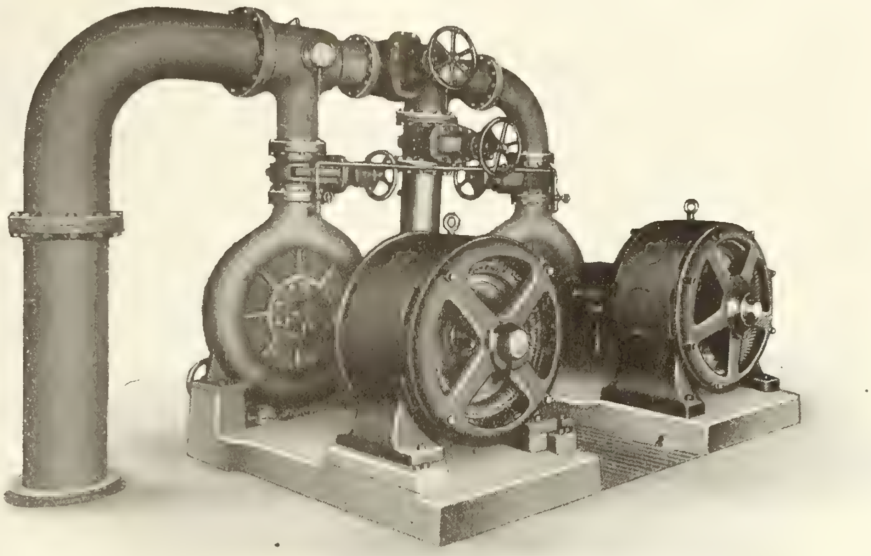
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

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The most durable and least expensive Paint made for preserving Iron or Steel in Bridges, Buildings, Structural Shapes, Gas Plants, etc.

Galvanum Paint

The only Paint that will adhere for years to Galvanized Iron roofing, siding, cornices, etc.

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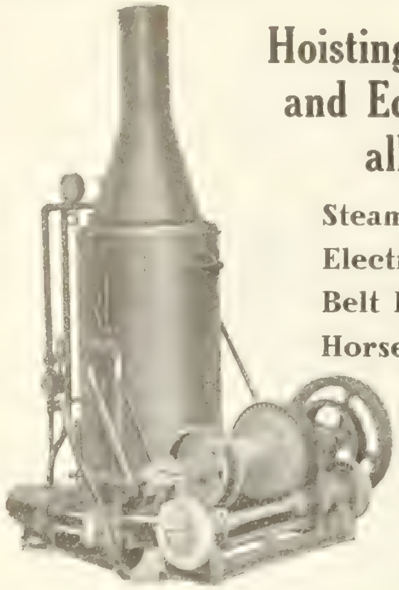
The only Paint that will beautify and make walls, ceilings, tile, concrete, brick and stone walls moist-proof and sanitary. Produced with strong luster finish or semi-luster, or flat finish. Can be frequently washed without injury.

Manufactured in the United States and England by

The Goheen Manufacturing Co.

CANTON, OHIO., U.S.A., and Dock House, Billiter St., LONDON, E.C., ENG.

For sale by SANDERSON PEARCY & CO., LIMITED, Toronto, Ontario, Canada



10 H. P. Reversible Builders' Hoist, supplied in seven sizes up to 50 H. P. Reversing or non-reversing.

Hoisting Machinery and Equipment of all kinds

Steam Hoists
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Hand Power Hoists and Derrick Irons to suit any requirements.

Steel Cars, Skips, Buckets, etc. to order.
Steel work of all kinds a specialty.

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BELLEVILLE, ONT.
Makers Hoisting Machinery
Sales Agents: MUSSENS, LTD., MONTREAL

County Academy, Sydney, N. S. Built of Sydney Pressed Brick

Our plant is the only one of its kind in Canada making pressed brick from blast furnace slag. Brick made from this material is hard as flint—hardens with age and adheres with great strength to mortar.

Prices and Particulars on Request

Sydney Pressed Brick Co.
Limited
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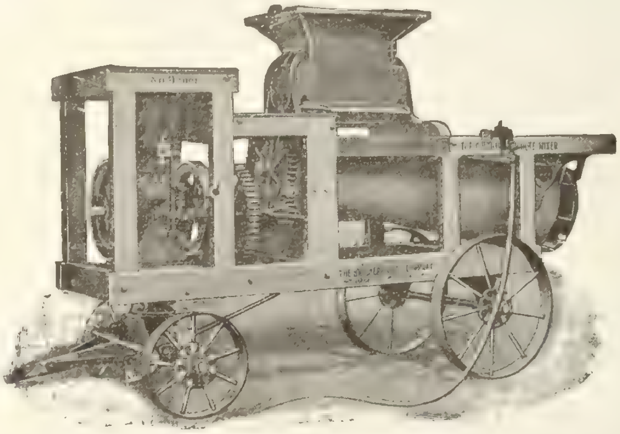
DEPENDABILITY



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First—because of its mechanical design.
Second—because only the highest priced labor and materials are used in its construction.
Third—because it is equipped with the Novo Gasoline Engine, known throughout the country as the most reliable gasoline engine built for this kind of work.

So you see, because of its design, construction and power, the Coltrin has to be dependable.

The joy of having a mixer that will never balk and is always ready, at a minute's notice, for use on a small job or to run continuously for weeks on a big job—this joy comes to every contractor and engineer who owns a Coltrin.

If you are thinking of adding to or changing your present equipment, you ought to learn what hundreds of other men in your same line of work have to say about the Coltrin.

Send for their actual letters to-day—you really ought to see them.

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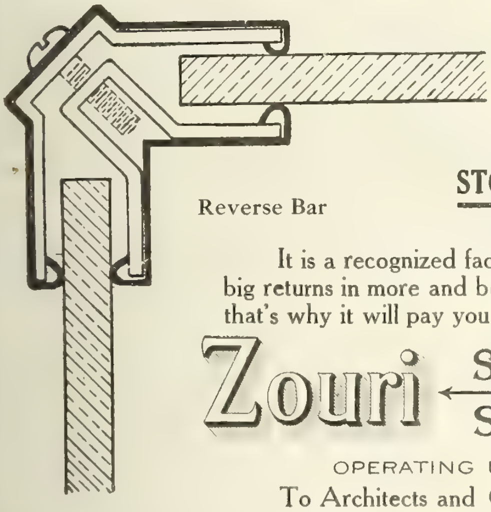
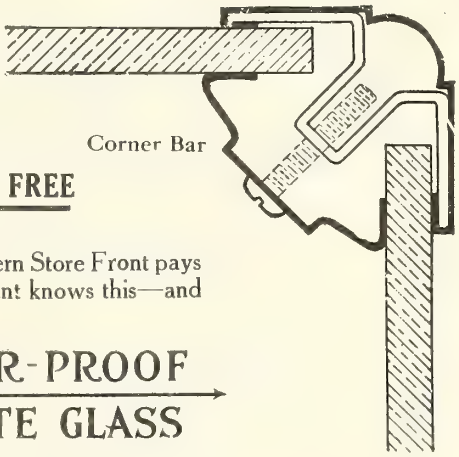
Modern Store Front of Dan Cohen, Louisville, Kentucky.



Reverse Bar



Corner Bar

STORE FRONT BLUE PRINTS, FREE

It is a recognized fact that for the money invested a modern Store Front pays big returns in more and better business. Every good merchant knows this—and that's why it will pay you to specify

Zouri SAFETY & BURGLAR-PROOF SETTING FOR PLATE GLASS

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To Architects and Contractors we will send, *free*, Blue Prints and full size details of

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Canadian Car and Foundry Co., Montreal

Canadian Plant
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We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Buildings and Structural Material.

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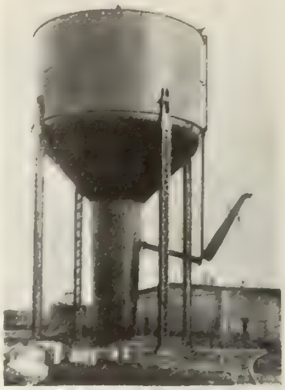
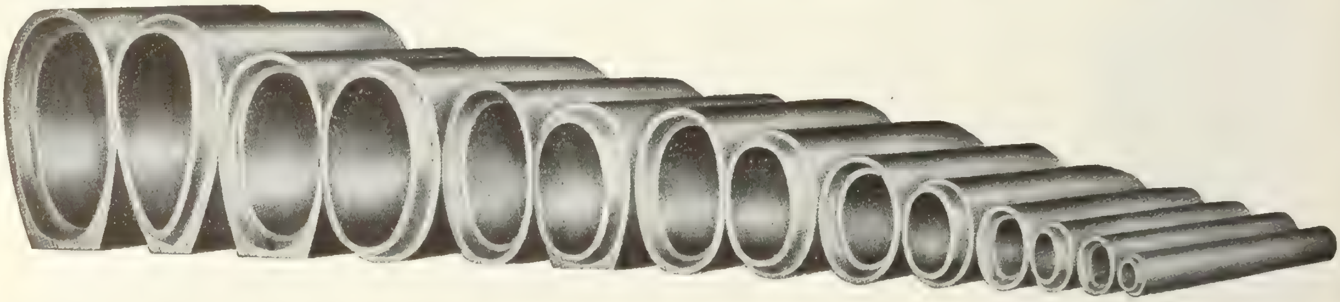
Dallas, Texas, U.S.A.
Greenville, Pa., U.S.A.

SHOPS—BRIDGEBURG, ONT., CAN.
Chicago, Ill., U.S.A.
Greenville, Penn., U.S.A.



Grand Trunk Pacific Ry.
Lines West of Winnipeg



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properly built of properly made
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LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

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Catalogue and prices on application.

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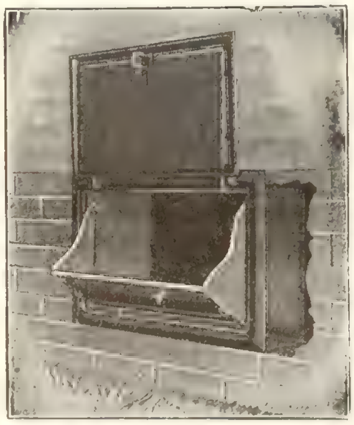

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar.. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

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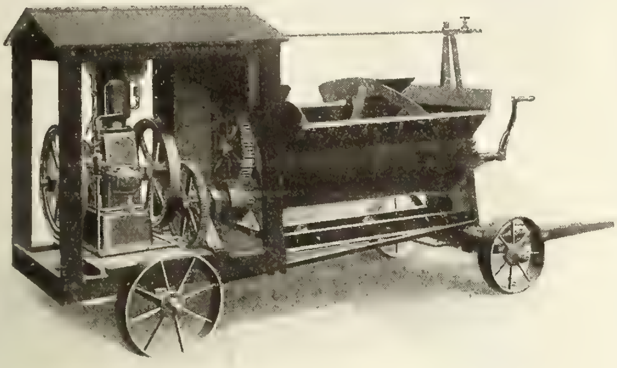

The Blystone Mounted Mixer with Power

You will do your concrete mixing quicker and cheaper with the Blystone Mixer. This is not what we alone say but what all users say. This mixer is adaptable to all kinds of work. We are willing to prove its advantages to you—give us the opportunity.

Simple, Durable and ALWAYS READY

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N. J. Dinnen & Co., Limited, Winnipeg, Man.
Gorman, Clancy & Grindley, Calgary, Alberta.
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in our beautiful patterns, embossed in steel sheets, improve stores, halls, homes and public buildings. They are durable, easy to clean, and prevent the spread of fire.

Instal a "Metallic" Ceiling and walls in your store or office, and the attractive result will certainly help you to develop many profitable sales. Write to-day for our illustrated catalogue on "Metallic" Ceilings and Walls.

THE METALLIC ROOFING CO.
OF CANADA LIMITED.
TORONTO AND WINNIPEG

Contractors' Acetylene Flare Lights

Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

SIZE NO. 2—

1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

Price F.O.B. Ottawa $65.00.

Manufactured by

International Marine Signal Co. Limited
Ottawa, Canada

FOR SALE

1, 10 x 16 Slidevalve Engine
2, 40 H.P. Tubular Boilers
1, 10 Ton Derrick Complete
1, 30 H.P. Dick Kerr Motor
1, 40 H.P. Bullock Motor
2, 2 H.P. 2 Phase Motors
1, No. 5 Pulsometer Pump (New)
1, 1/2 Yard Milwaukee Concrete Mixer
1, 7 x 10 Blake-Marsden Crusher
1, Pair 5 Foot Edge Rolls
1, No. 3 Gates Crusher with Elevator and Screen Complete
1, 6" Morris Sand Pump Steam Connected
1, 7 x 12 Beatty Hoist with Swinger
1, No. 4 Champion Stone Crusher
1, 6 x 3 x 7 Cameron Sinker
1, Buckeye Trench Excavator

The above machines are but slightly used and are in good working order.

Fleming Machinery Company
340 Sparks Street, Ottawa, Can.

These Three Plows Are Made Especially For The Use of The Contractor

Verity No. 4 Railroad Grader

Made entirely of steel (excepting the malleable hand holds), and is consequently a very strong Plow, and adapted to heavy grading. Everything about it will be found of the best, both as to material and construction.

Verity Pick or Pavement Plow

This tool will tear up macadamized streets, cement walks, hardpan, rock and frozen ground. Except the handles it is entirely of iron and steel and is of such strength as to withstand all strain.

Beam and standard in one piece. Pick is 3 x 1 in. Crucible steel and is reversible.

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Beam and Standard are one solid piece of iron extending around the beam lengthwise.

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are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.

Standard Compression Hydrant

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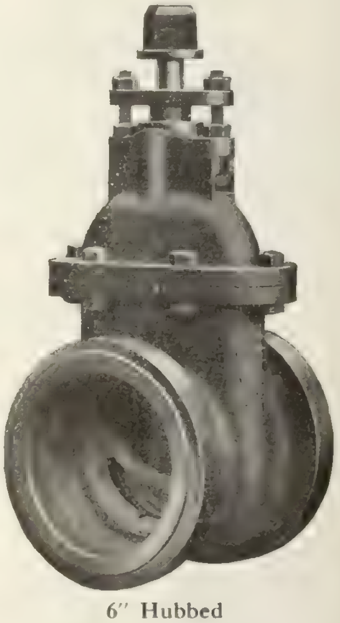

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WALKERVILLE, ONT.

Sturtevant
(REG. U.S. PAT. OFF.)

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Sturtevant Turbo Blower for Forced Draft Work

STURTEVANT Steam Turbines are simple, reliable, and always ready. They show exceptionally low steam consumptions in actual operation. They are especially adapted for driving fans, centrifugal pumps, and electric generators. Used by the New York Edison Company, the Indiana Steel Company, and other large corporations after thorough investigation of all competing machines.

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Eastern Sales Office – 919 New Birks Bldg., Montreal
Selling Agents for Sanford Riley Stoker Co., Ltd. No. 996

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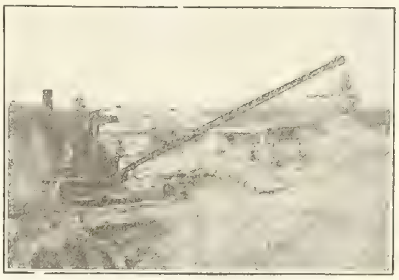

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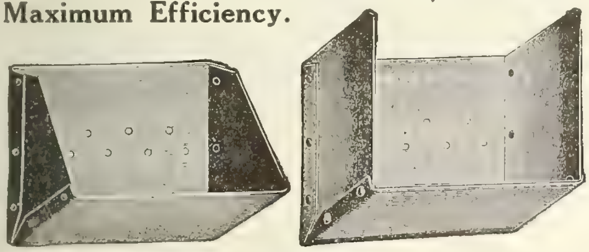
"Weller" on Machinery

is a Guarantee to Highest Quality and Maximum Efficiency.



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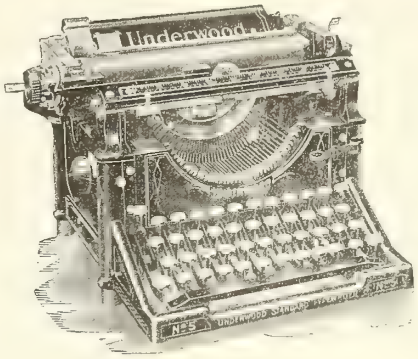

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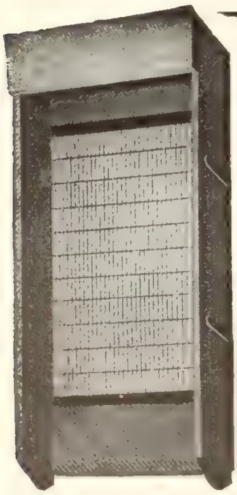

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We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
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Pioneer Manufacturer of

Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.

The benefit of 20 years experience as successful contractors.

Yours for the Asking

Hotchkiss Lock Metal Form Co.
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Manufacturers of

Sand and Lime Brick

BUILDERS—note these points:

OUR PLANT has a capacity of 40,000 bricks per day.
It has excellent delivery facilities.
It is the most modern plant in the city.

OUR BRICK are carefully made under expert supervision. They are fireproof.
They absorb from 10% to 12% less moisture than ordinary clay brick.
Their crushing strength, 3030 lbs. per sq.in. by actual School of Science test, is far greater than ordinary stock brick.
They are the same size as standard stock brick.
They do not break so easily as clay brick and the percentage of bats and culls is very low
They are uniform in color, size and quality.
The older they are, the harder they get.
They give the most value for the least money.

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HERE is a brand of hard wall plaster that is always ready for immediate use.

It saves from four to eight weeks' time in completing your building because it sets quickly.

Costs less than lime.

Anchor Plaster sets hard as rock and will never come down. Use it for your next job.

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Toronto Agents for
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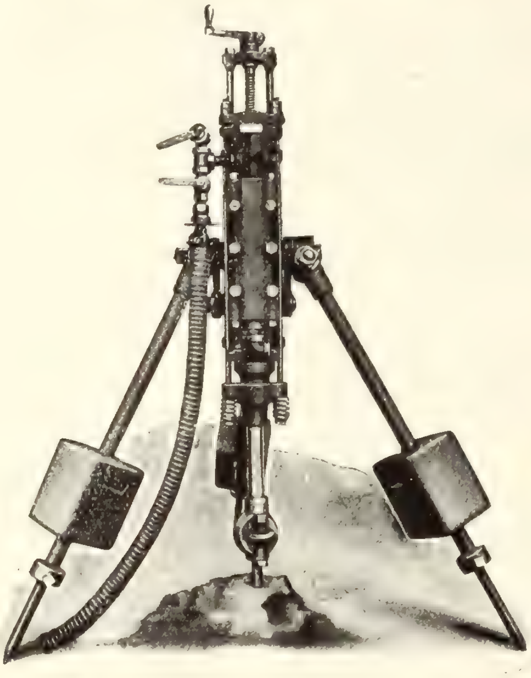
McKiernan-Terry

CORLISS VALVE ROCK DRILLS



Corliss Valve Rock Drill

The Type "T.C." is a Corliss Valve machine and differs from all other rock drills in which the valve is moved by mechanical or tappet action. It is actuated by two tappets which move freely within a tappet block seated in the cylinder beneath the centre of the valve chest. The tappets, by contact with the inclined surfaces of the piston, move up and down and so impart a rotary or turning motion to the valve, by which means it is operated. So well is it balanced, that the slightest amount of power is required to move it.

The Corliss Valve Drill is economical in power, strikes a quick and powerful blow and has a pullback of remarkable strength. It is as well adopted for use with air as it is with steam.

This is a view of a 3¼ inch Corliss Drill engaged in channelling

When required to work with low steam pressure or "wet" steam, it shows greater superiority over all other drills and under such conditions, it operates with a degree of flexibility only expected of an air machine. The great power exerted on the return stroke adapts it for drilling in soft rock which forms a heavy sludge and does not "mud" freely, as well as for use in hard fitchering ground which tends to stick and bind the steel in the drill hole.

CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturers of :—Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Shovels, Steam Specialties, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Wheels.

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Supplied by
Gibbs & Canning, Limited
Tamworth - England

from Best Staffordshire Clay.
Works established over halt a Century.
All Colors with plain or dragged surface or with Matt Glaze.
For further information, samples and estimates, enquire of the following agents—

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J. J. Laferme, 44 Beaver Hall Hill
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Scott, Hammond & Pratt, Limited, 65 Victoria Street
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Barker & North, 26 Princess Street

If You Are Interested

in prompt shipments, at economical prices, of high grade

Bare Copper Wire
Weatherproof Wire
Rubber Insulated Wire

we solicit your inquiries.

We have large, fresh stocks of these materials and can make immediate shipment of orders, large or small.

Write to-day to our nearest office for quotations.

Standard Underground Cable Co., of Canada, Limited
Hamilton, Ont.
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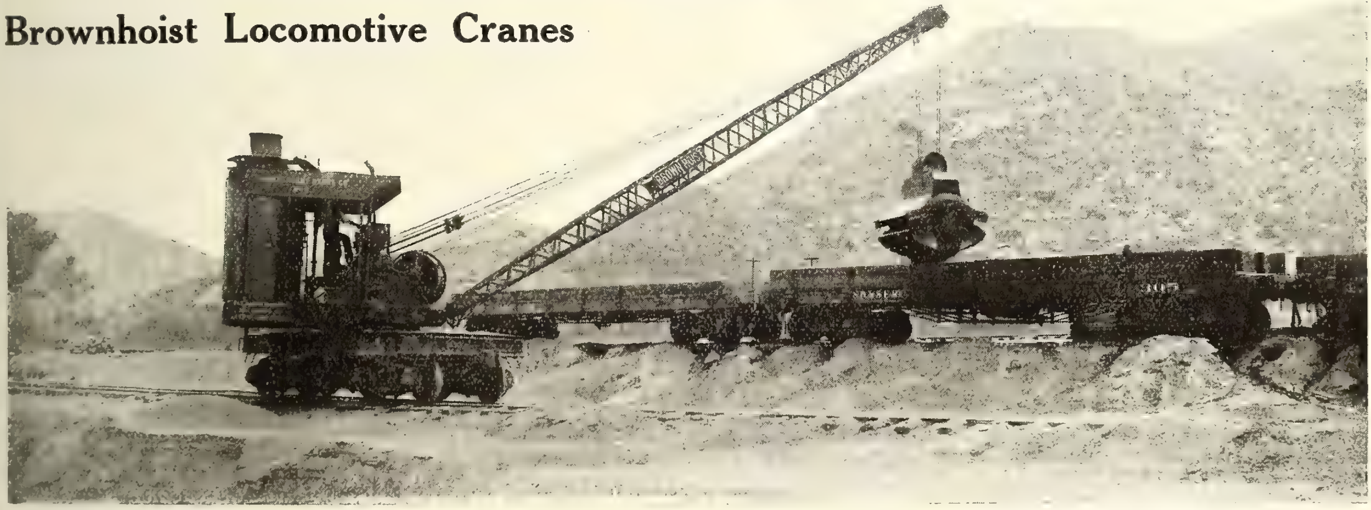
Manufacturers of Electric wires and Cables of all kinds, all sizes for all services, also Cable Terminals, Junction Boxes, etc.

Brownhoist Locomotive Cranes



15-Ton Brownhoist Locomotive Crane used by the Independent Stone Co., San Diego, Calif.

If you handle stone, gravel, sand, coal, etc., you should investigate the use of Brownhoist Locomotive cranes for your work. Each crane, equipped with a Brownhoist Patent Grab Bucket, handles these materials 1 to 2 tons at a load, from and to stock pile, cars, boats, wagons and bins. And the crane also does the switching of the cars.
These cranes are being used in all sections of the country and you should investigate their operations.

Write for our new catalog K which shows how and where these cranes are being used.

THE BROWN HOISTING MACHINERY CO., CLEVELAND, O.
New York Pittsburgh Chicago San Francisco The Colby Engineering Co., Portland, Ore.

NATIONAL PIPE & FOUNDRY CO., LIMITED

WATER WORKS CONTRACTORS

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WOODEN WATER PIPE

For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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The Maritime Bridge Company, Limited

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Bridges—Steel Buildings
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Estimates Furnished Promptly

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MR. CONTRACTOR!

Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

SAND & SUPPLIES, LIMITED

Phones: Adelaide 1947-1948

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AYR, - ONTARIO

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THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

The Canada Iron Corporation, Limited

CAST IRON PIPE

Head Office:
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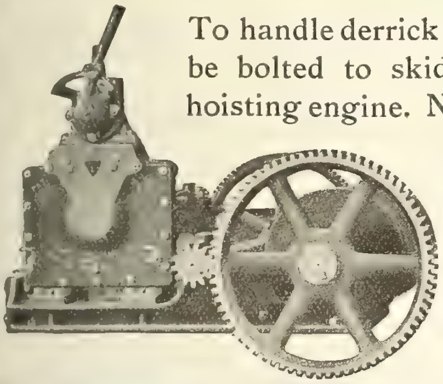
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The Dake Swinging Gear

To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.



Start, Stop, Reverse at Will

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Dake Engine Co.
Grand Haven, Mich.

When you want stone that appeals specify

"Queenston Blue" Limestone

Send us your specifications for Cut Stone work

The Queenston Quarry Co., Ltd.
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The Ready Mixed
Hard Wall Plaster

Manufactured by

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100 Bleury Street - - MONTREAL

"Galvaduct" and "Loricated"

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for Interior Construction

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Sole Manufacturers under Canadian and U. S. Letters Patent
Toronto - Canada

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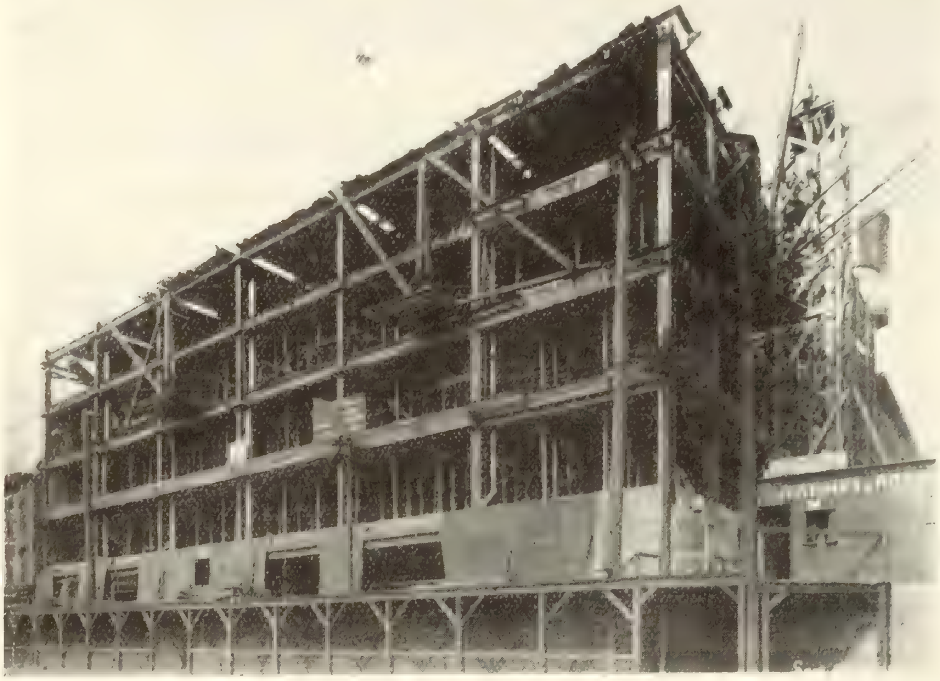
every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments Offices, Works and Docks, TORONTO



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of New
Nine Storey
Factory for

Christie Brown and Company

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ENGINEERS AND
CONTRACTORS

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Displaying a complete line of **MISSISQUOI** And all varieties of Foreign **MARBLES**

Which are open for inspection at all times
to Architects, Builders and Contractors.

Any Request to Submit Tenders Will be Given Prompt Attention.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 “	4 60	6 75
41 to 50 “	5 10	7 50
51 to 60 “	5 35	8 50
61 to 70 “	5 75	9 75
71 to 80 “	6 25	11 00
81 to 85 “	7 00	12 50
86 to 90 “		15 00
91 to 95 “		17 50
96 to 100 “		20 50
101 to 105 “		24 00
106 to 110 “		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ “	2.28	⅜ “	3.18
½ “	2.72	½ “	3.57
¾ “	3.28	¾ “	4.43
1 “	4.85	1 “	6.55
1¼ “	6.56	1¼ “	8.86
1½ “	7.84	1½ “	10.59
2 “	10.55	2 “	14.25
2½ “	16.67	2½ “	22.52
3 “	21.80	3 “	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

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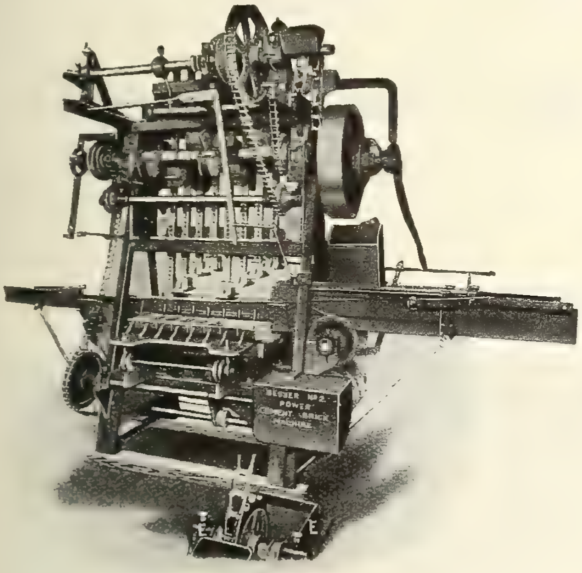

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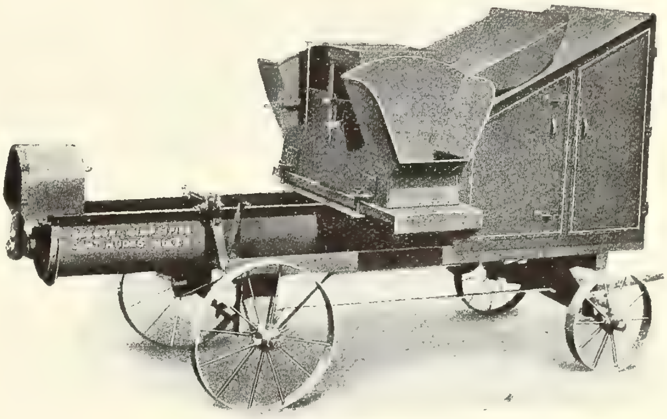

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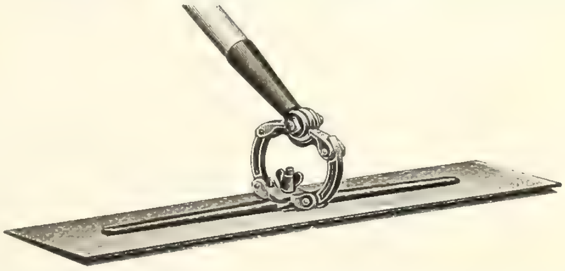

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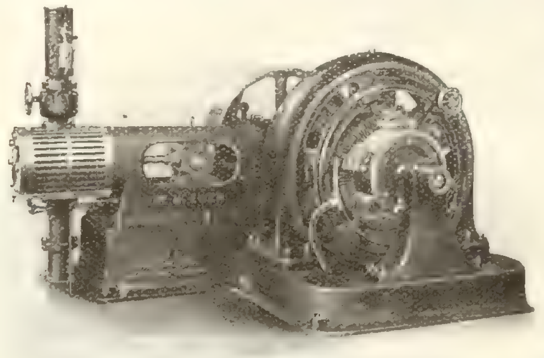

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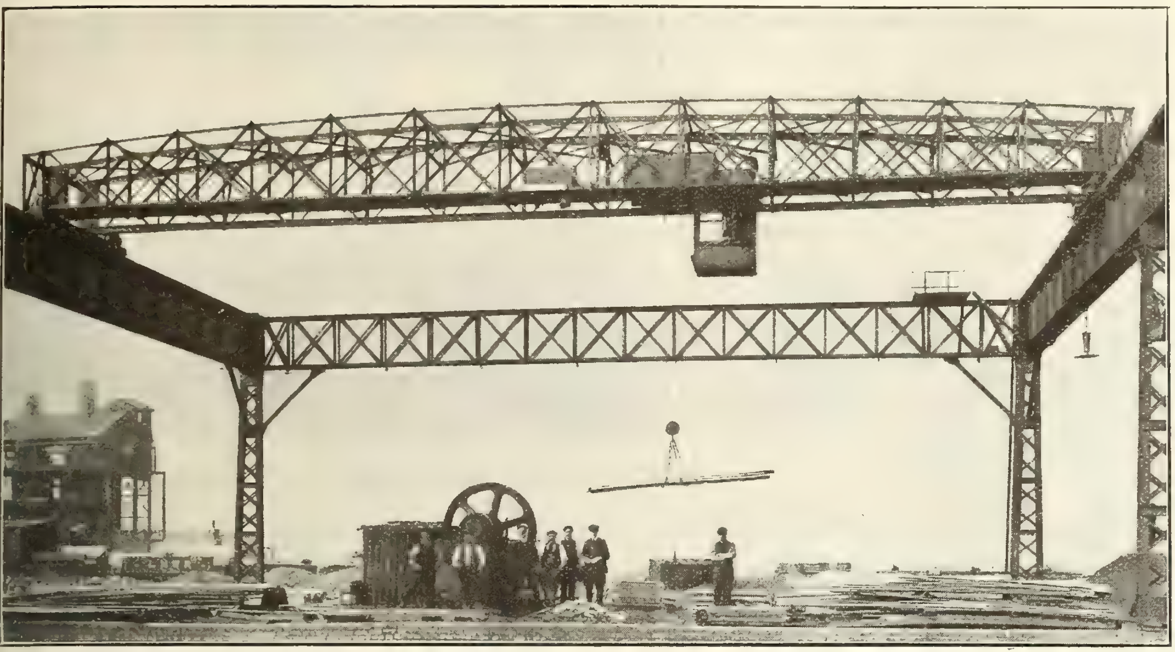

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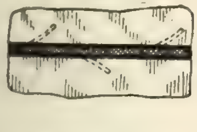
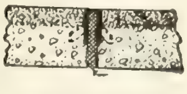


Longitudinal Section Showing Joint.



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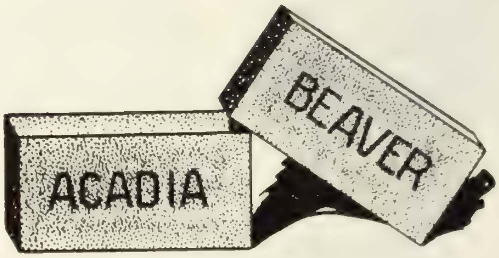

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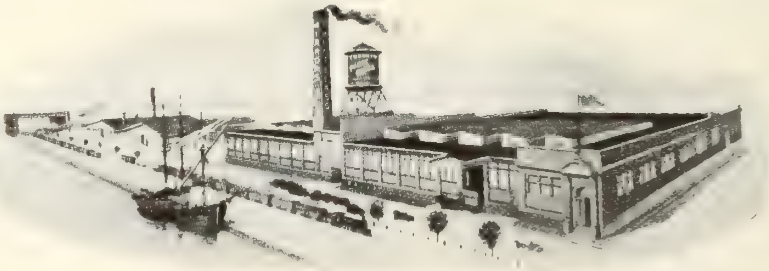

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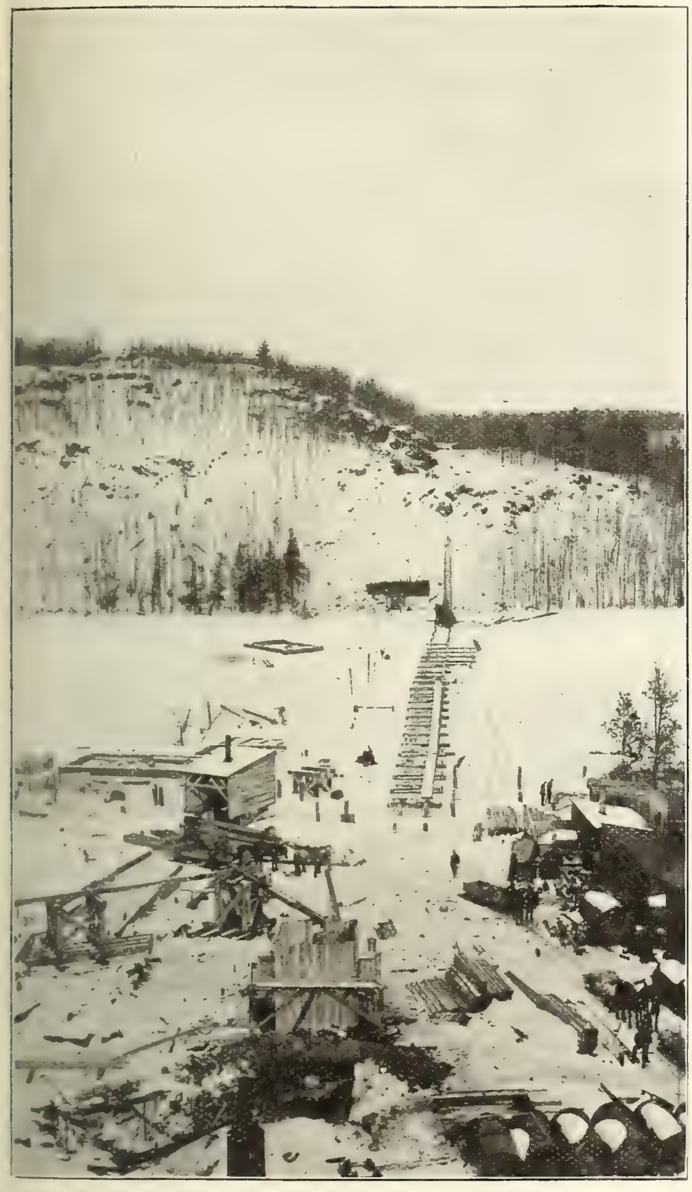

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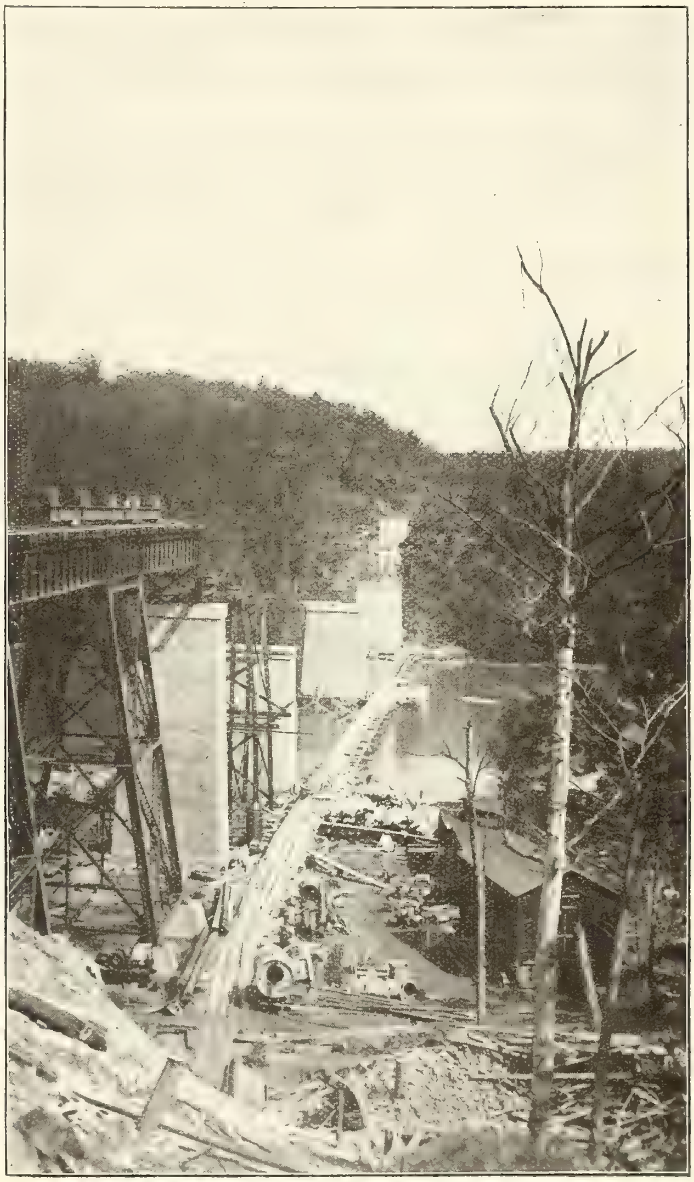

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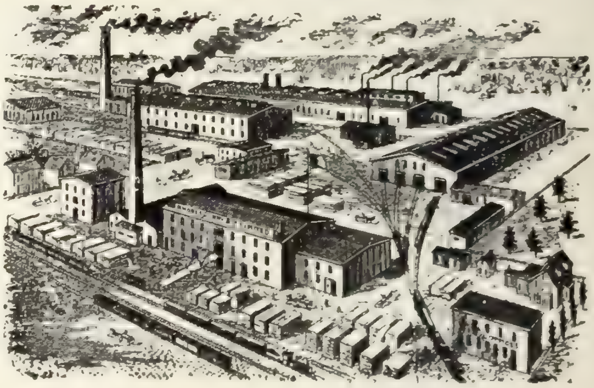

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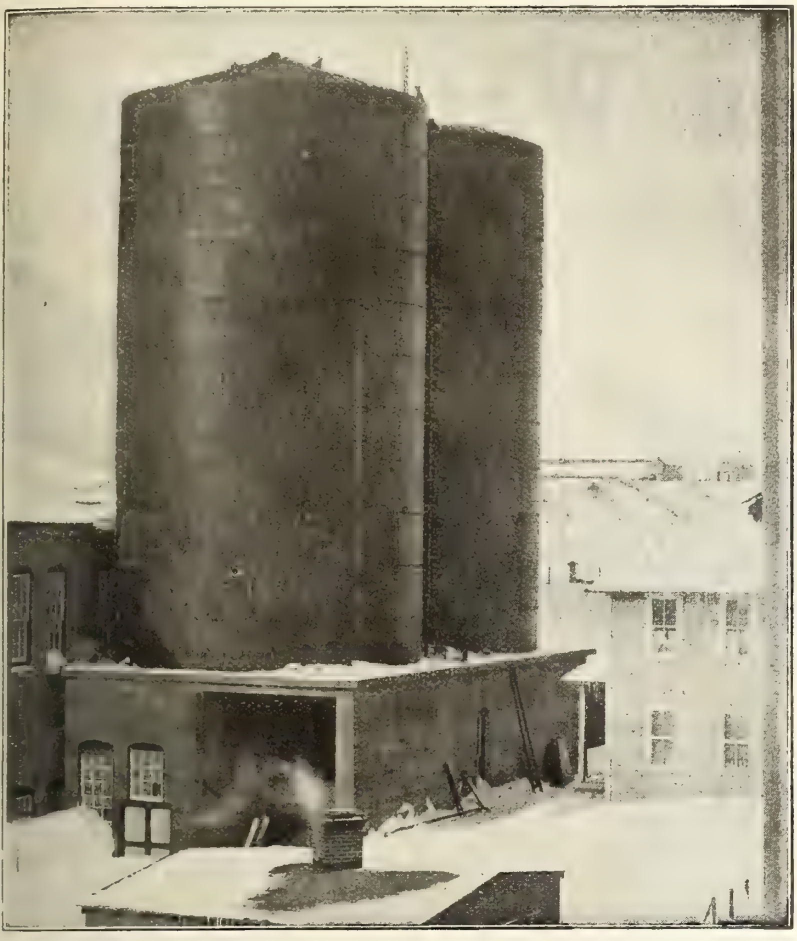

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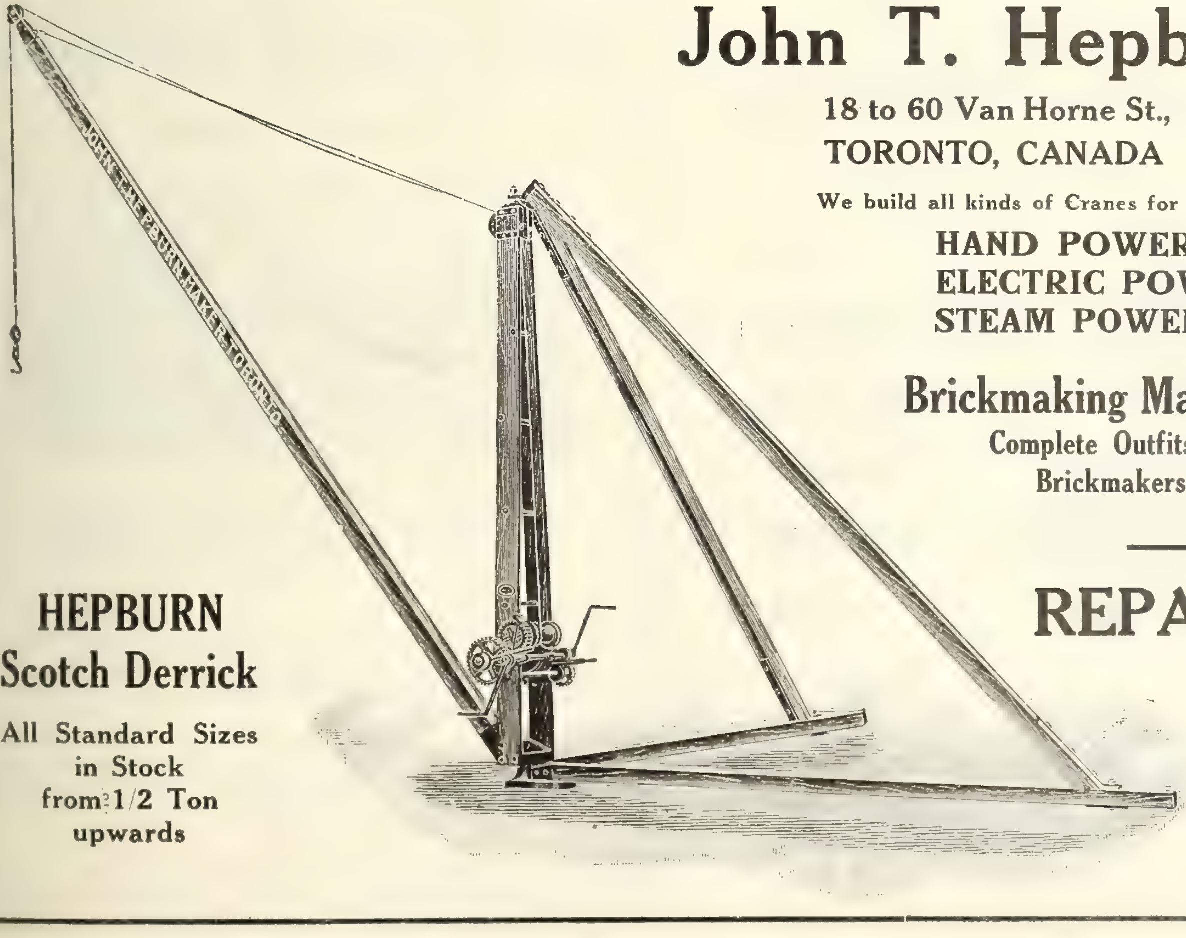
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Ask for Prices

International Marine Signal Co. Limited
Ottawa, Canada

The Des Moines Hemispherical Bottom Steel Tanks and Towers
have been used and approved by nearly all leading Engineers. They are undoubtedly the most economical means of storing water at an elevation.
We have built many of these in Canada the United States and Mexico. Estimates cheerfully furnished.

Send for Catalog No. 15

"Engineers desiring one of our Tank Calculators will receive same upon application."

Des Moines Bridge & Iron Co.
Pittsburg, Pa., U.S.A., 945 Curry Bldg.
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F. H. Hopkins & Company, Canadian Representatives, Montreal, Quebec.

Steelwork-when-you-want-it
Standard Steel Construction Co. Limited
Welland - Canada
Manufacturers and Erectors of
Steel Buildings and Bridges
If you are intending to purchase **Steelwork** for any purpose, it will be to **your interest** to permit us to quote.

THE DOMINION WOOD PIPE COMPANY
LIMITED
NEW WESTMINSTER, B.C.
MANUFACTURERS OF
DOUBLE WIRE WOUND

AND
CAST IRON SPECIALS, VALVES, HYDRANTS, ETC.

"AMERICAN"
ENAMELED BRICK
Combine Beauty, Strength and Durability.

Write for Catalog "FIFTH EDITION" illustrating the standard sizes, colors and many of the special shapes.
SAMPLES—miniature or full size, will be forwarded, if desired.
Prompt attention given formal inquiries.

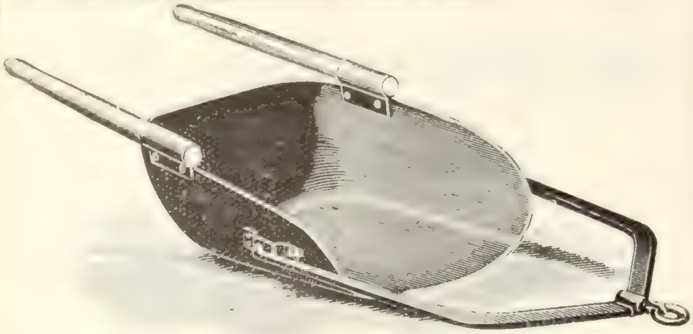
AMERICAN ENAMELED BRICK & TILE COMPANY
1182 Broadway, New York.

Sarnia Bridge Company Limited
SARNIA - CANADA
WE ARE MANUFACTURERS OF
Structural Steel of All Kinds

Railway and Highway Bridges
Steel Buildings

Beams, Channels, Angles, Plates etc., in stock

ESTIMATES AND DESIGNS FURNISHED ON APPLICATION



Easy to Fill: Easy to Dump

OUR drag scrapers are enjoying wide popularity because of their easy filling and dumping qualities. These famous

IRON AGE

scrapers are made with pressed bowls of high carbon steel—free from joints and seams.

They are stiff, serviceable and long lived.

Have you our catalogue?

THE BATEMAN-WILKINSON CO., LIMITED
340 CAMPBELL AVE., TORONTO

BUILDERS SUPPLIES

- Lime
- Portland Cement
- White Cement
- Keenes Cement
- Plaster Paris
- Hard Wall Plaster
- Mortar Colors
- Fire Brick
- Sewer Pipe
- Weeping Tile
- Sacketts Plaster Board
- Parkers Corner Bead
- Rubble Stone
- Crushed Stone, Etc.

With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

Ontario Lime Company
Limited

Crown Office Building, Toronto, Ont.
Head Office Phones: Main 5472—5473

"EBANO" and "EAGLE" Brands

MEXICAN ASPHALT

HERKIMER ST., HAMILTON. Paved with our Mexican Asphalt.

Write for analysis and samples

The
Asphalt & Supply Company, Limited

Sole Canadian Agents for the Mexican Eagle Oil Co.
Also Agents for MASTIC ASPHALT for Sidewalks.

428 Transportation Bldg., MONTREAL

460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a **HEINICKE.**

Write for catalogue

H. R. HEINICKE, INC. New York, U. S. A.
Representatives for Canada:
Black Building Supply Co,, Ltd. Toronto
Dartnell Ltd., Montreal, Que.

Renfrew Lime

Will save you money

NOT because it is cheaper than other limes but because it has some advantages not found in other brands.

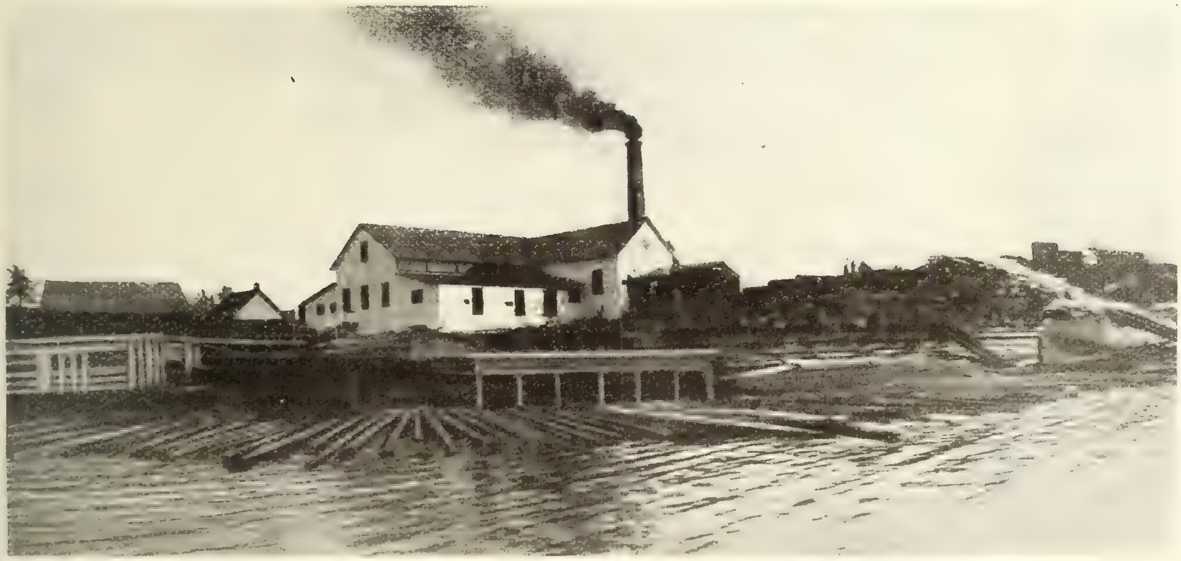
It is easily bedded down and does not set too rapidly, allowing the bricklayer to spread for more bricks. It requires but little time for tempering and sets hard as a rock.

Try "Renfrew" Lime on your next job.

White Lime — Stone — Gray Lime
Brick — Drain Tile

Jamieson Lime Company
Renfrew, Ontario

TIMBER

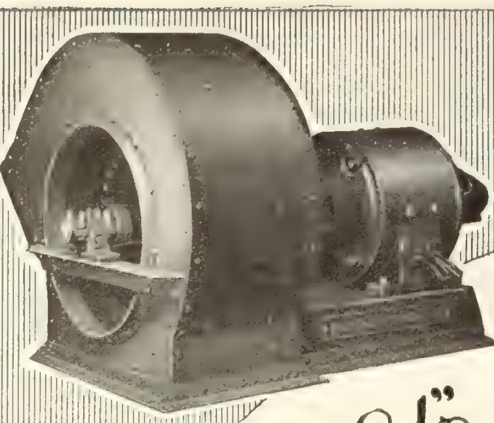


TIMBER

OUR EXPERIENCE — OUR STOCK — OUR MILLS
AT YOUR SERVICE

Heavy Yellow Pine and Fir Timbers up to 80 ft. on hand

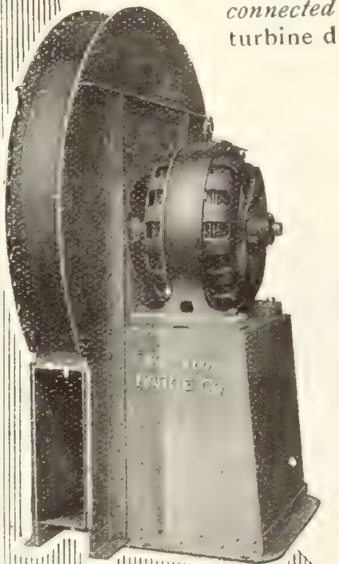
James Sheppard & Son
Sorel, Quebec



“Buffalo” Fans

For Heating, Ventilating, Drying and Exhausting.

Ask our engineers to recommend the fan best suited to your requirements. Our designs include the new high-efficiency “*Conoidal*” multiblade fan, used extensively for heating systems, mine and tunnel ventilation, and the motor-driven *Steel Plate Pressure Blower*, giving pressures up to 24 oz. Both of these designs show higher efficiency than obtained with any similar types. We specialize in *direct-connected* units (motor, engine or turbine driven) for every service. These are distinguished by absence of belt troubles and the very lowest power consumption. Whatever your problem write us.



CANADIAN BUFFALO FORGE CO., Limited
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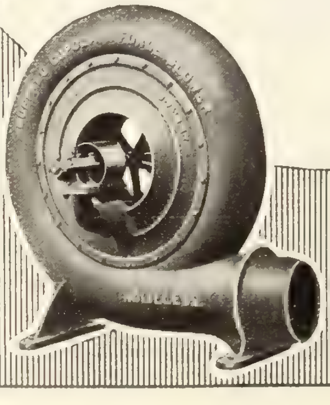


Protect Your Buildings As Well as Insure Them!

Prevention of fires is vastly better than the partial redress which is all the best Fire Insurance Policy can give you. This prevention is easily secured by using

Asbestocement Building Materials

TRADE MARK
ASBESTOSLATE
ASBESTOS SHINGLES

make roofs that are handsome, ***fireproof,*** practically everlasting and moderate in price.

Linabestos Building Board
prevents inside fires from spreading. It is quickly applied, and gives a permanent, attractive, yet inexpensive interior finish.

Asbestos Corrugated Sheathing
makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely ***weather and fire proof.***

You build for all time when you build in Asbestocement.

Write for Booklet **C. R.** and state in which products you are particularly interested.

Asbestos Mfg. Co., Limited

Address—E. T. Bank Bldg., 263 St. James St.
MONTREAL
Factory at Lachine, P.Q. (near Montreal)

MACK

13 Questions For the Contractor To Answer

The Perry Sand Co., of Buffalo, using Mack Trucks

If as a contractor you are not using motor trucks, ask yourself the following questions and answer them honestly:—

1. How many horses have you?
2. How much money have you invested?
3. How much does it cost per day to operate your teams?
   (a) Including interest on total investment for horses, trucks, harness and other equipment?
   (b) Stable charges?
   (c) Drivers, etc.?
4. What is the life of a horse?
5. Do you figure depreciation on this basis?
6. How many cubic yards or tons can you haul per day?
7. Are you willing to be convinced that motor trucks can do this amount of work at a lower cost?
8. Can you improve your loading and unloading facilities to reduce time lost in this way?
9. What is your average length of haul?
10. How many trips can you make with horse trucks?
11. Do you know that a single automobile truck is doing the work of four horse teams in your business?
12. Is there any reason why the automobile truck cannot do as much for you?
13. Isn't it worth your while to investigate this situation?

Ask us about the "MACK"

The Canadian Fairbanks-Morse Co., Limited

St. John, N.B. Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver

8

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Fifth of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

C. P. R. Hotel, Calgary

This building was wired with
"Adanac" Rubber Insulated Wire

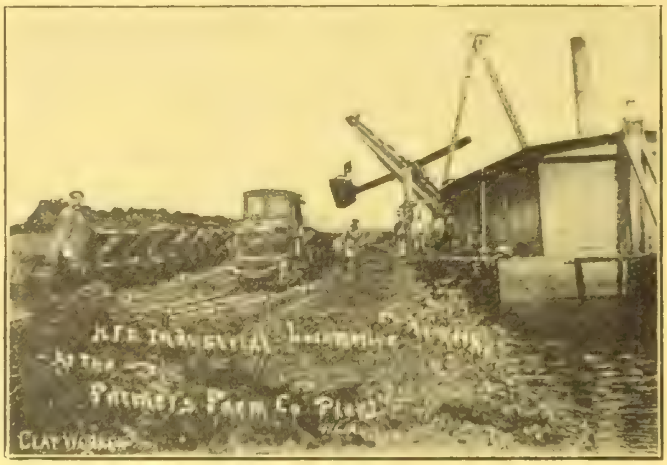
Architects and Engineers: E. & W. S. Maxwell, Montreal
Electrical Contractors: Parker-Chase Electrical Construction Company, Calgary.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd. Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"



Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

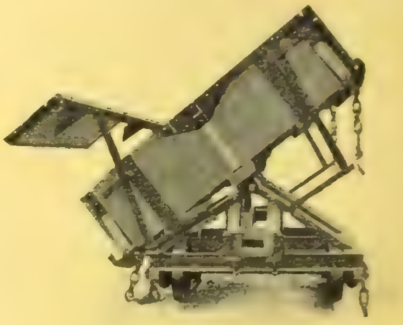
Suitable For

Brickyards, Quarries, Mines, Contractors, etc.

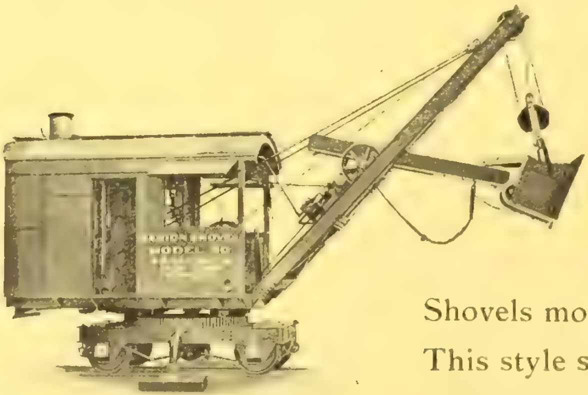
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars



We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
58 - 1 and 1 1 2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

BRANCH OFFICES: **General Supply Company of Canada, Ltd., Winnipeg Agents**
Ritchie Contracting & Supply Company, Ltd., Vancouver Agents

Vol. 27 Toronto, November 5, 1913 No. 45

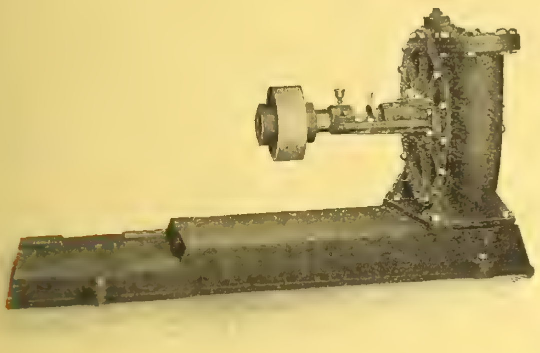
Contract Record and Engineering Review

ESTABLISHED 1886

We manufacture all kinds of

Steam and Power Pumps

for all kinds of service, using only the best material and workmanship.



THE SMART-TURNER MACHINE CO.
HAMILTON, CANADA LTD.

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

Air Compressors

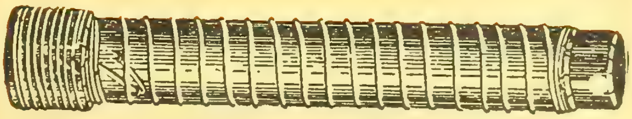
OF BELLISS MAKE

have gained their reputation for

Simplicity of Design
Noiseless Running
Compact Design
Low Oil Consumption
Continuous Operation
Overall Efficiency

Messrs. Belliss & Morcom, Ltd.
BIRMINGHAM, ENGLAND

Agents
Laurie & Lamb
Board of Trade Building, MONTREAL



Continuous and Machine Banded Wood Stave

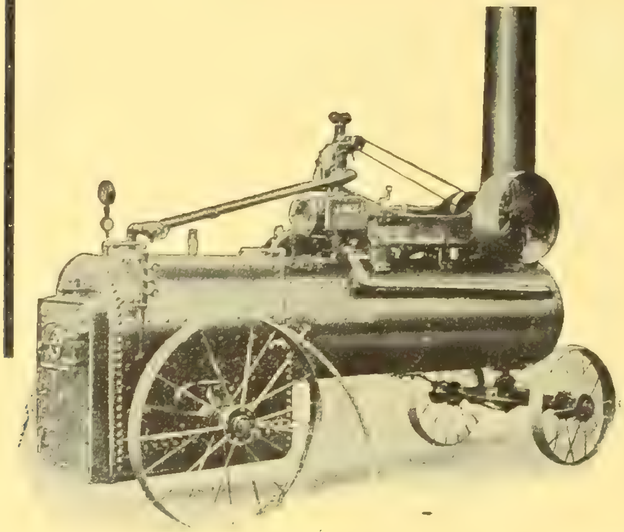
WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6

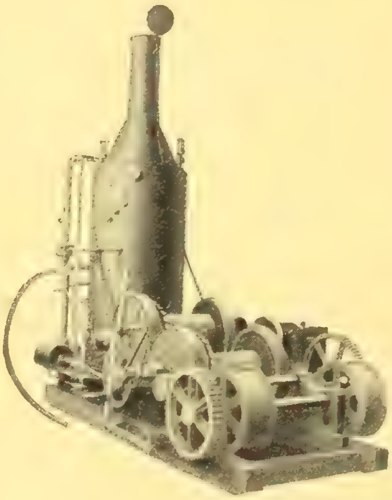


PORTABLE POWER PLANTS

THE cut shows one of our compact and *portable* power plants for driving Crusher Outfits, etc. A complete power plant in itself—durable and efficient. We build different sizes and can meet your requirements precisely.

The Jenckes Machine Co.
Limited

General Offices:—Sherbrooke, Que.
Works:—Sherbrooke, Que.; St. Catharines, Ont.
Offices:—Sherbrooke, Montreal, Toronto, St. Catharines, Cobalt, South Porcupine, Nelson, Vancouver.



When you buy an "AMERICAN" Engine there is no Long List of Extras to pay for

The steam fixtures are the best procurable, **and they are all there**—gauge cocks, water gauge, steam gauge, safety valve, sight feed lubricator, and a perfectly working automatic injector with six feet of suction hose.

We furnish a tool box as a matter of course. It contains wrenches, oil can and extra water glass. An ash hoe and poker are furnished with every engine having a boiler.

When we deliver an engine all you need supply is the water and coal—and less of the latter than for any other engine of the same rated strength.

MADE BY

American Hoist & Derrick Company

SOLD BY ST. PAUL, MINN., U. S. A.

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CANADA Portland CEMENT

SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
PORTLAND
CANADA
CEMENT
MONTREAL

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

Canada Cement Company, Limited

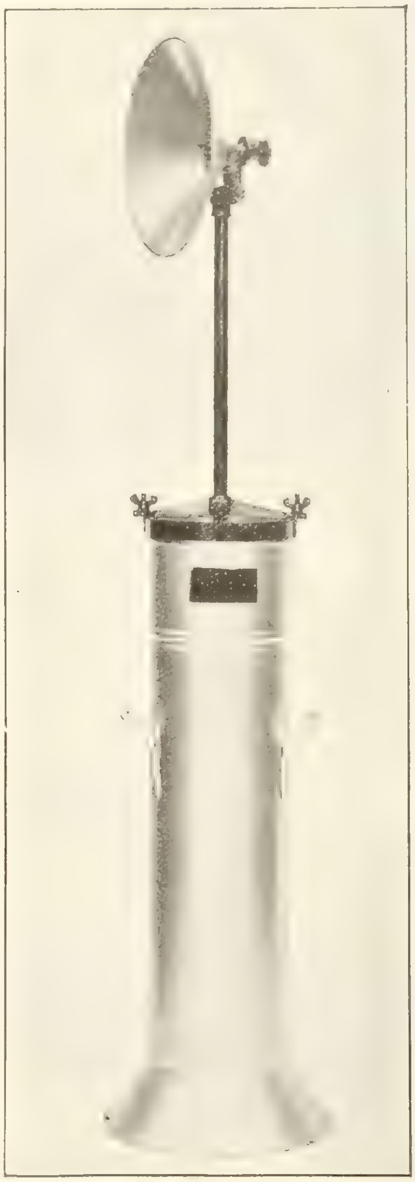
Head Office - Montreal

Sales offices at

Montreal - Toronto - Calgary - Winnipeg

It's Important

that you get your contract finished before the cold weather sets in.



The

Carbic Light

will enable you to work overtime.

It gives a clear white light of 2,000 C. P. and turns your night into day.

Carried in Stock

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COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 365 Water Street

QUEBEC, 71 Maple Ave.
ST. JOHN, N. B., 57 Smythe St.
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The

Carbic Light

is what you want these short days when extra time means so much.

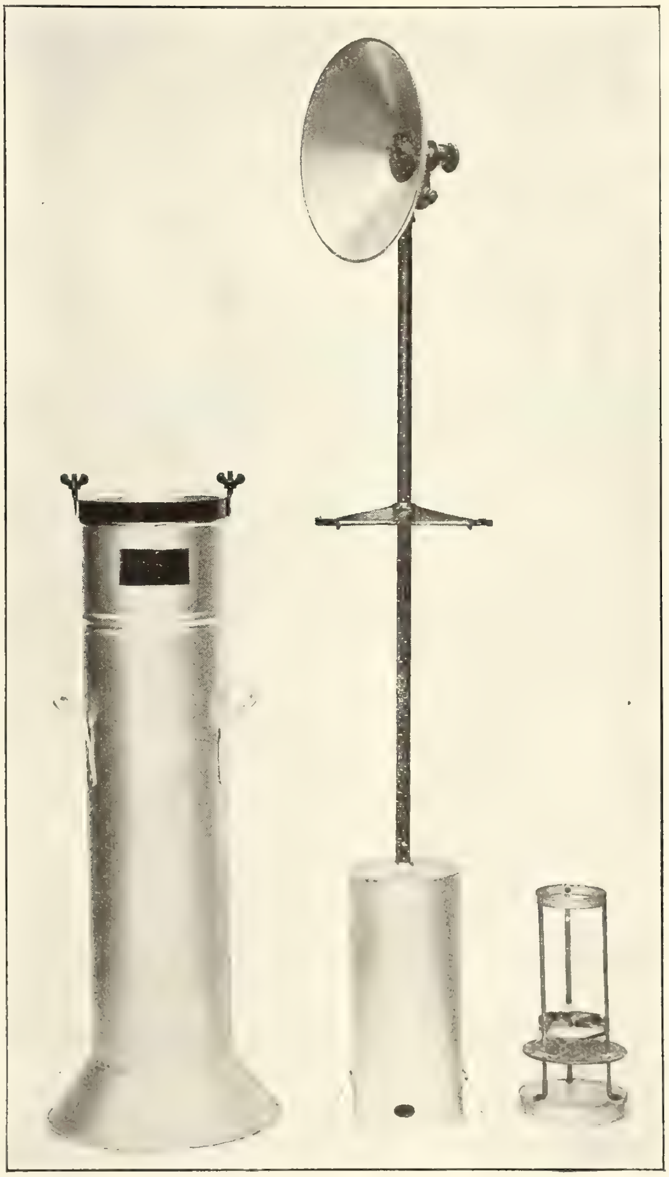
The cheapest and most efficient light for

Contractors
Railways
Culvert
Tunnel
Steam Shovel
and
Dredge Work

Simple and strong in construction — only three parts—see illustration.

Burns six and twelve hours without recharging.

Send for particulars.



Mussens Limited

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- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Sheldons Limited

High Pressure Pipe Lines
- Boving Company of Canada
- Escher Wyss & Co.
- Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Engineering Co
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis.
- Marsh & Henthorn
- Mussens Limited
- Royce Limited
- Sturtevant Co. of Can. Ltd. B. F

Hoisting Engines
- Canadian Allis-Chalmers, Ltd
- Canadian Fairbanks-Morse Co.
- Wettlaufer Bros.

Hydrants
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co
- Kerr Engine Company

(Continued on page 12)

Headquarters, Fire Department, Adelaide St. West, Toronto

Don Valley Bricks

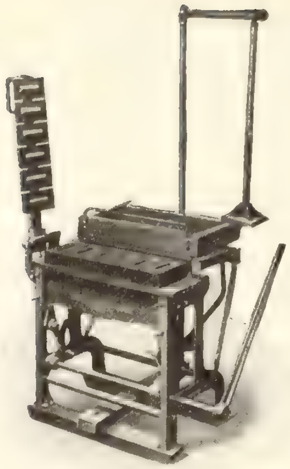
The above building erected under the supervision of Toronto's city architect is built of Don Valley Clay Products.

Don Valley Eatonia Brick was used for the outer walls and the building is fireproofed throughout with Don Valley Porous Terra Cotta. The result is an imposing fireproof building that will look as fresh and clean cut in twenty years as it does today.

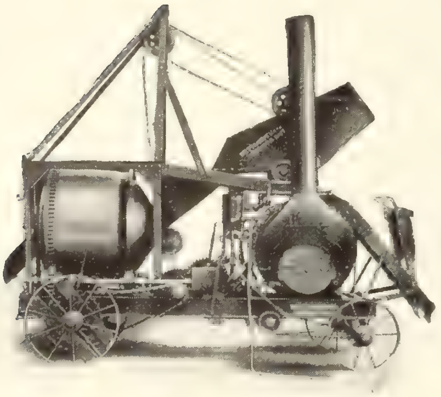
For pleasing and permanent effects in brickwork Specify "Don Valley Brick."

Don Valley Brick Works

Toronto, Ontario

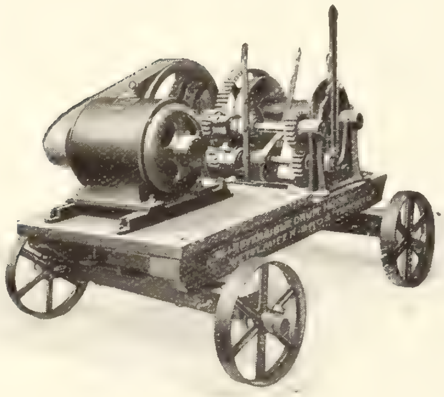


Wettlaufer
Concrete
And
Contractors' Machinery



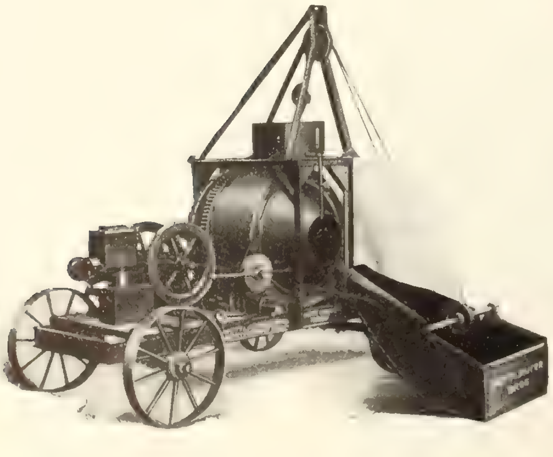
THE Wettlaufer line of contractors' equipment is complete and most economical to operate.

The famous Wettlaufer Heart Shape Drum Mixers are the most thorough mixers on the market—This is proved daily by the hundreds of mixers in use in every part of Canada.



The Wettlaufer reversible single drum motor driven hoist mounted on wheels or skids is an ideal machine for light work. Easily portable, it saves much time and trouble.

Daily demonstrations are held at all our branches—call and see the demonstration of the machines that interest you.



Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont., Buffalo, N.Y., Detroit, Mich.

AGENCIES:

A. E. Holgert, Regina, Sask. Maysmith & Lowe, 1057 Mears St., Victoria, B.C. A. R. Williams Machinery Co., 15 Dock St., St. John, N.B. The Canadian-British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man. R. F. Mancill, 117 10th Ave. East, Calgary. The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C. J. L. Lachance, Ltd., 363 St. Paul St., Quebec. Wettlaufer Bros., 316 Lagauchetiere St. West, Montreal, Que.

Rogers' Portland Cement

AND CRUSHED STONE

The most dependable for all types of construction and engineering-contracting work — especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, &c.

Rogers' Brands:

PYRAMID DORIC SUPERIOR
STERLING SAUGEEN

Mills at:

KIRKFIELD ST. MARY'S HANOVER
ORANGEVILLE OWEN SOUND

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

Concrete Tank at Berlin, Ont.
BUILT WITH ROGERS' CEMENT.
L. J. MENSCH, M. Am. Soc. C.E., CHICAGO, ILL.
Engineer and General Contractor.

Crushed Stone

Our crushed stone is free from dust, dirt and mold—it is really clean stone–properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

Will You Try This Great MUELLER Water Tapping Machine?

A MUELLER Water Tapping Machine ought to be in the service of EVERY Water Works Company and Plumber in Canada.

20 to 30 years of service perfect is a common record for MUELLER machines. Every feature of strength and durability has been built into them. Every simplicity has been adopted. Read our 30 day trial offer.

Every piece of MUELLER Goods, whether for Water Companies' use, Plumbers', or Gas Companies' use, is ***Unconditionally Guaranteed*** against any manufacturing defects. Every article must pass a 200 pounds hydraulic pressure test as well as a rigid inspection before leaving our factory.

Sent on 30 days' trial

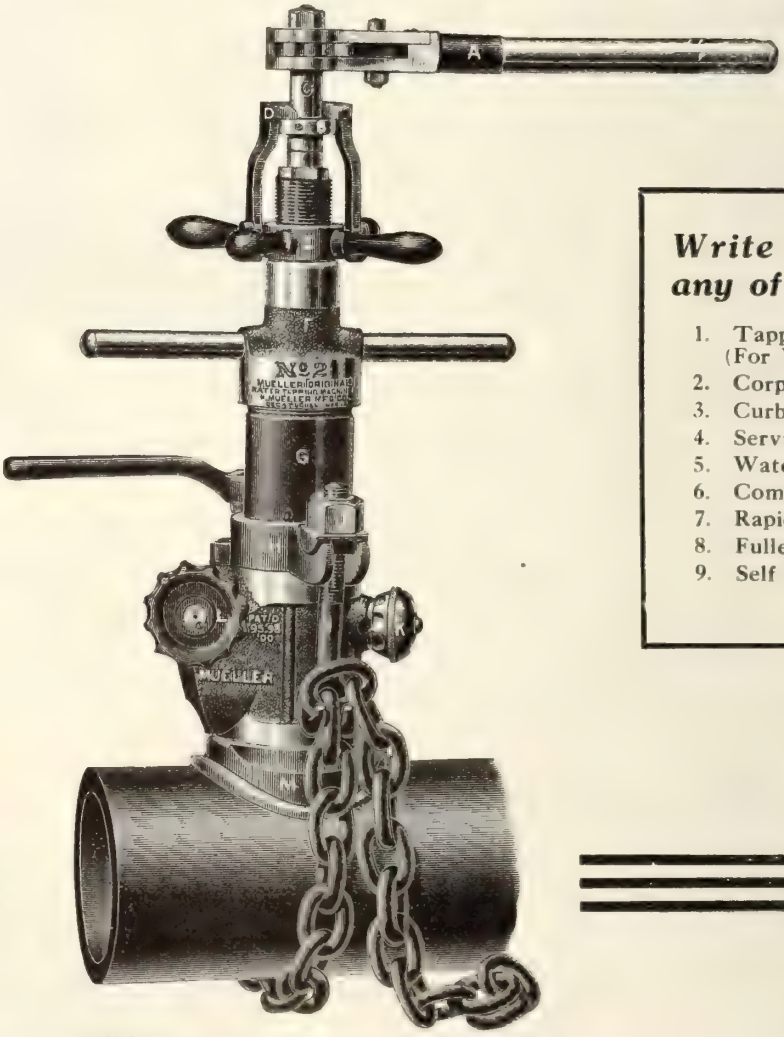
Write us today for one of these great MUELLER tapping machines for a good 30 days trial. If every claim we have made for it does not "prove up," we will cheerfully take it back. Be sure to write us today.

H. MUELLER MFG. CO., LTD.

SARNIA, ONTARIO

Decatur, Ill. **Chicago** **San Francisco** **New York City**

"MUELLER Water Tapping Machines are built to endure, and always work sure."


A
D
No 2
MUELLER ORIGINAL WATER TAPPING MACHINE
G
MUELLER

MUELLER No. 2 Tapping Machine

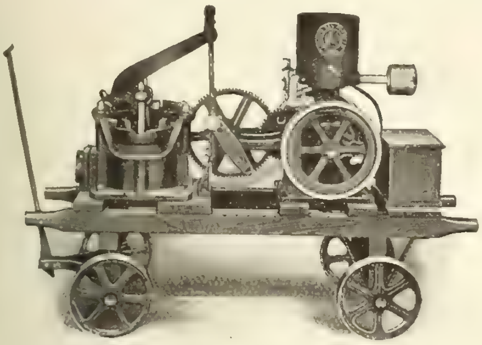
Write us about any of these

1. Tapping Machines. (For Water or Gas)
2. Corporation Cocks.
3. Curb Cocks.
4. Service Boxes.
5. Water Connections.
6. Compression Work
7. Rapidac Work.
8. Fuller Work.
9. Self Closing Work.

etc.

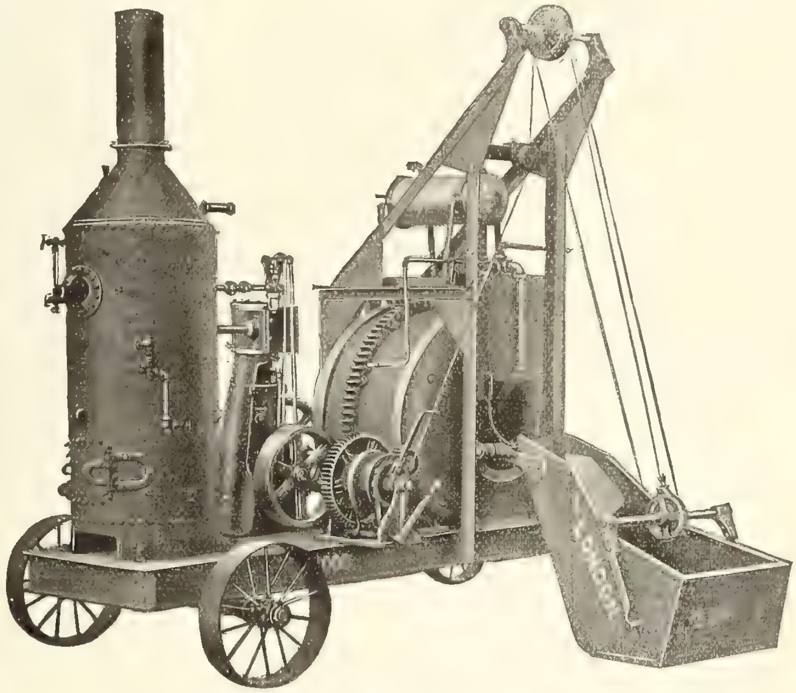
Before You Buy Concrete Machinery

or Equipment of any kind, write us for our 180 page catalogue.



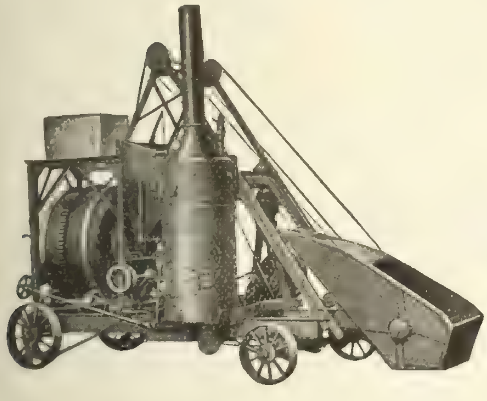
Power Diaphram Pump

We are the largest manufacturers of Concrete Machinery in Canada.



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

We do not build machinery down to a price but up to a standard.

London Sill Step and Window Cap Mould

A few lines we manufacture—

Concrete Mixers, Mortar Mixers, Tile Moulds, Drain Tile Machines, Side Walk Tile Machines, Cement Block Machines, Cement Brick Machines, Sill Step and Window Cap Moulds, Gasoline Engines, Screens and Elevators Fence Post Moulds, Hoisting Engines, Material Elevators, Concrete Carts, Wheelbarrows, Scrapers, Sidewalk Forms, Pumping Outfits

A complete line of Contractors' Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:
WINNIPEG (445 Main St.) W. H. Rosevear, Mgr. CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (60 Richmond St.E.) F. D. Emsley, Mgr.

AGENCIES:
VANCOUVER, B. C. Equipment Co. MOOSE JAW, Sask. Bridge & Iron Co., Ltd. REGINA, H. A. Knight
FORT WILLIAM, Northern Eng. & Supply Co. MONTREAL, Foss & Hill Mach. Co. QUEBEC, A. D. Masson

We are the Largest Manufacturers of Concrete Machinery in Canada

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Insulating Compounds
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- Rhodes Curry & Co.

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- Jamieson Lime Co.
- Ontario Lime Co., Ltd.

Lime Kilns
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- Boving Company of Canada
- Canadian Allis-Chalmers, Ltd.
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- Bechtels Limited

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- Jenckes Machine Company
- Canadian Allis-Chalmers, Ltd
- Waterous Engine Works

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- Boving Company of Canada.
- Canadian Allis-Chalmers, Ltd.
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- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
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- Hamilton Mfg. Co., Wm.
- Hopkins & Co., F. H.
- Inglis & Company, John
- McDougall Caledonian Iron Wks.
- Smart-Turner Machine Co.
- Waterous Engine Works Co.
- Mussens Limited
- Ontario Wind Eng. & Pump Co.
- Wettlaufer Bros.

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- Mussens Limited

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- Western Wheeled Scraper Co

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- Shunk Plow Company

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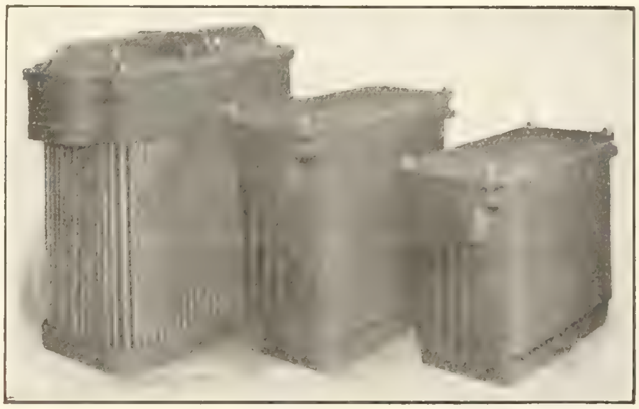
- Barber Asphalt Paving Co.
- Bird & Son, F. W.
- Can. H. W. Johns-Manville Co.
- Metallic Roofing Company
- Noble, Clarence W.
- Paterson Mfg. Co.

(Continued on page 14)

Power Logic

Reduced Loss
Increased Profit

Ferranti
Transformers



The Transmission line that is equipped with Ferranti three phase transformers is always a profitable one because of the great reduction in energy-loss made possible by these efficient transformers.
All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

Three phase transformers are the most economical type to operate and will effect a considerable saving in construction cost.

Three Phase Pole or Station Transformers

Write us for particulars

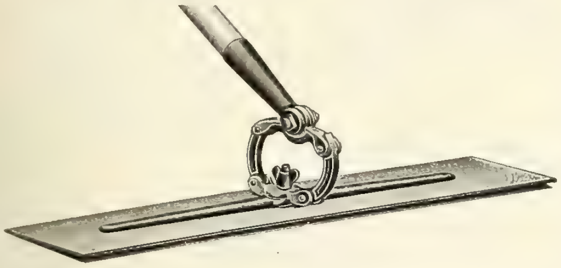
The Ferranti Electrical Co., of Canada, Limited

TORONTO
90 Sherbourne St.

WINNIPEG
56 Albert St.

Save $8.00 a Day

on Sidewalk Finishing



EVERY set of "Abram" Cement Tools is sold on the guarantee that it will enable one man to do the work of three. Finishers at $4.00 a day meaning a saving of $8.00 per day on your sidewalk finishing. We do not guess or calculate this statement—we guarantee it and if we cannot prove it with a set of "Abram" tools we will refund your money.

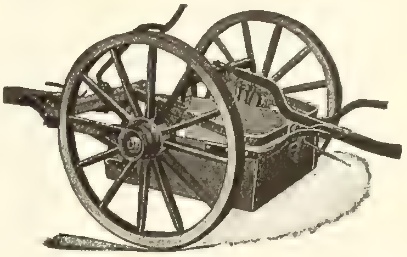
Send for catalogue today

Abram Cement Tool Co.

105 Ouellette Ave. Windsor, Ont.

STRENGTH IN STEEL

IN
BOX
OF
PAN
OF
THE



Western Wheeled Scraper

is made of one piece of steel, bent without heating, thus preserving the original hardened surface.

The Levers, Tongue Irons, Front, Back and Draft Hooks and Bails are made of steel. The size of material used on the tongue iron has been considerably increased so as to give added strength.

With these Scrapers you can do more work with less men. They have many features found in Westerns only.

Let us send you Catalog.

Western Wheeled Scraper Co.

AURORA, ILLINOIS
Earth and Stone Handling Machinery

Hagersville Crushed Stone

The Toughest Stone for Macadam in Ontario

Record of Logan Avenue, Toronto, Macadamized from Queen St. to Gerrard St., in 1902

Length 2,454 Lin. Ft. Width 24 Lin. Ft. 6,550 Sq. Yds.

COST FOR REPAIRS

1903	$ 0.00	1908	$ 93.26
1904	3.30	1909	200.46
1905	9.35	1910	14.07
1906	37.33	1911	2.29
1907	16.11		

Total $376.17 or 5⅔c. per sq. yd. for repairs for nine years, a little over 6-10 of 1c. per sq. yd. per year.

Why Not Use Hagersville Stone and Get These Results?

Hagersville Contracting Co.

Hagersville, Ont. Limited

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- Canadian Fairbanks-Morse Co.

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- Taylor, J. & J.

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- York Sand and Gravel Co.
- Alfred Rogers Limited

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- Shunk Plow Company

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- Canada Iron Corporation
- Dominion Sewer Pipe Co.
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- National Iron Works
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- Ontario Sewer Pipe Co.
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Steam Turbines
- Canadian Allis-Chalmers, Ltd.
- McDougall Caledonian Iron Wks.

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- Canada Steel Co., Ltd.
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- Lecky & Collis

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- Steel Co. of Canada
- Steel & Radiation, Ltd.

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- Brodie, James
- Consolidated Stone Company
- Contractors' Supply Company
- Crushed Stone, Limited
- Hagersville Contracting Co.
- Mahan & Company
- McMillan & Son, W.
- Morrison & Co., T. A.
- Myers Oakley
- Ontario Lime Co., Ltd.
- Queenstown Quarry Co.
- Rogers Supply Company
- Sackville Freestone Company
- Sand & Supplies
- Smyth & Ryan

Stone Saws
- Anderson, Geo.

Store Fronts
- Zouri Drawn Metals Co.

Structural Iron and Steel
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- Canada Steel Company
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- DesMoines Bridge Company
- Dominion Bridge Company
- Hamilton Bridge Works Co.
- Mackinnon Holmes & Co.
- Maritime Bridge Company
- McGregor & McIntyre
- Phoenix Bridge & Iron Works
- Reid & Brown
- Sarnia Bridge Company
- Steel Company of Canada
- Structural Steel Company
- Standard Steel Construction Co.
- Walsh Plate & Structural Wks.

Submarine Drills
- Lecky & Collis

Swinging Gears
- Dake Engine Company

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- DesMoines Bridge Company
- Hamilton Mfg. Co., Wm.
- Inglis, John
- Jenckes Machine Co.
- Marsh & Henthorn
- McDougall Caledonian Iron Wks.
- Ontario Wind Eng. & Pump Co.
- Piggott & Co., Thos.
- Walsh Plate and Structural Wks.
- Waterous Engine Works Co.

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- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.
- Canadian Sirocco Company

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- Tuec Company
- Canadian Allis-Chalmers, Ltd.
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company
- Pittsburgh Valve, Foundry & Construction Company

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- Standard Underground Cable Co. of Canada, Ltd.

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- Bird & Son, F. W.

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- Cabot Inc., Samuel
- Can. H. W. Johns-Manville Co.
- Ceresit Waterproofing Co.
- Wadsworth Howland Co.

Water Softeners and Filters
- American Water Softener Co

Water Tapping Machine
- Mueller Mfg. Co., H.

Water Turbines
- Canadian Allis-Chalmers, Ltd
- Boving Company of Canada
- Escher Wyss & Co.
- Hamilton Mfg. Co., Wm.
- McDougall Caledonian Iron Wks.

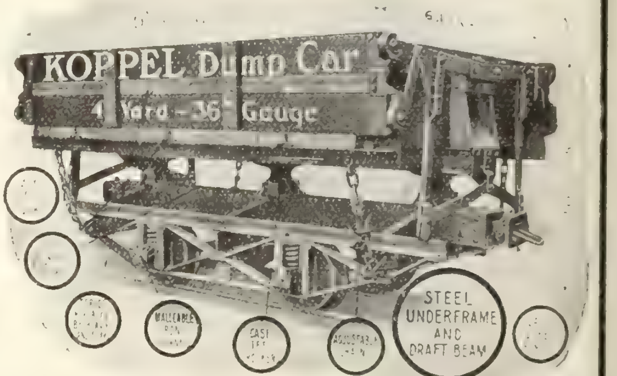
Wires and Cables
- Canada Wire & Cable Co.
- Imperial Wire & Cable Co.
- Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
- Canada Wire & Iron Goods Co.
- Greening Wire Co., B.
- Steel Company of Canada

Wire Rope
- Canada Wire & Cable Co.
- Greening Wire Co., B.
- Steel Company of Canada

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein - Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Barrett Specification Roofs

If you should specify merely "a five ply tar-and-gravel roof" instead of a "Barrett Specification Roof"—

You *might* get as good a roof as a Barrett Specification Roof though built somewhat differently—

But on the other hand, you may get materials of uncertain qualities,—

Or a roof with little or no pitch between the layers,—

Or a scanty surface coating of pitch and gravel—

And you wouldn't know about it until a few years later—*when the roof leaked*—

But if you put the Barrett Specification into your building specifications and see that it is carried out, you are sure—

1. That the materials will be right,
2. That they will be used in the right amount and in the right way,
3. That your roof will last upwards of twenty years without another cent of expenditure,
4. And that the cost per foot per year of service will be lower than it could possibly be with any other kind of roofing.

As Barrett Specification Roofs cost less than any other permanent roof to begin with and as their maintenance cost is nothing, the unit cost comes down to about ¼c. per square foot per year, a figure unapproached by any other roof covering.

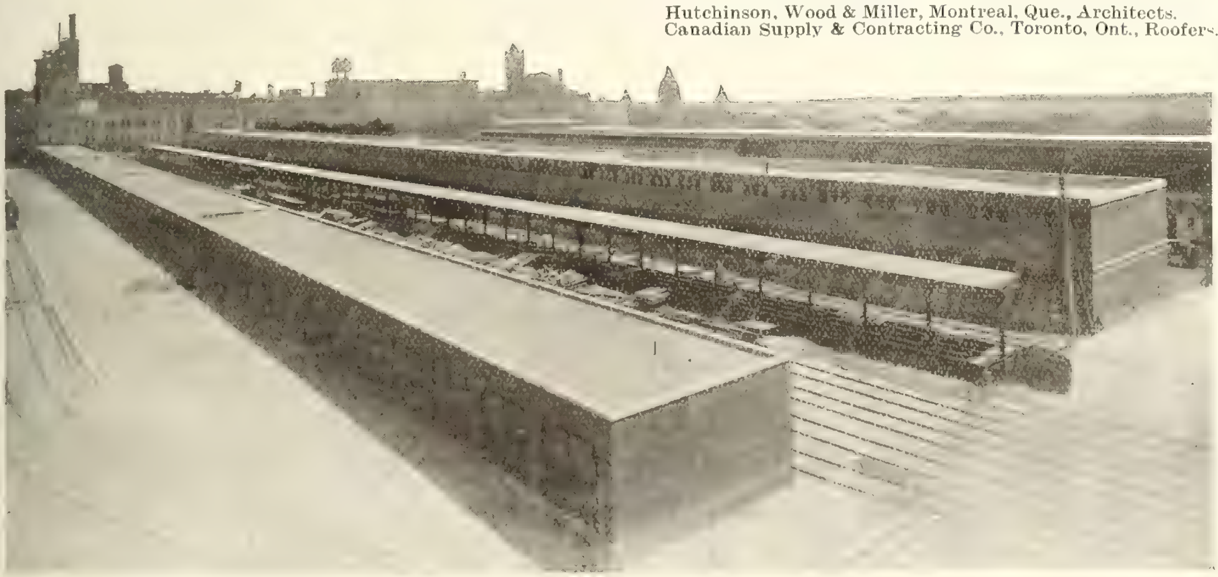
Copy of the Barrett Specification with tracing ready for incorporation into your building plans, sent free on request. Address nearest office.

Special Note We advise incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested. ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

THE PATERSON MFG. CO., Limited

Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

Hutchinson, Wood & Miller, Montreal, Que., Architects.
Canadian Supply & Contracting Co., Toronto, Ont., Roofers.



Canadian Pacific Railway Co.'s Freight Sheds, Toronto, Ont.

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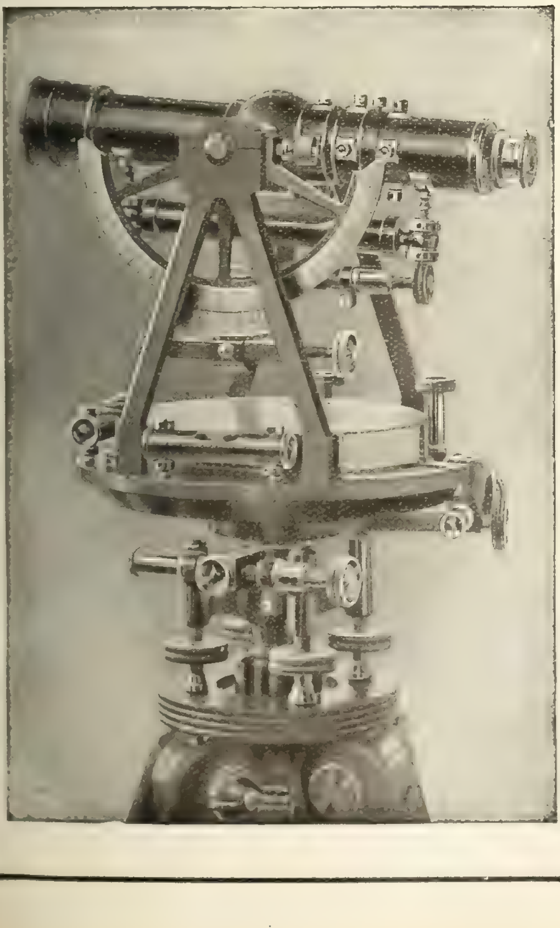

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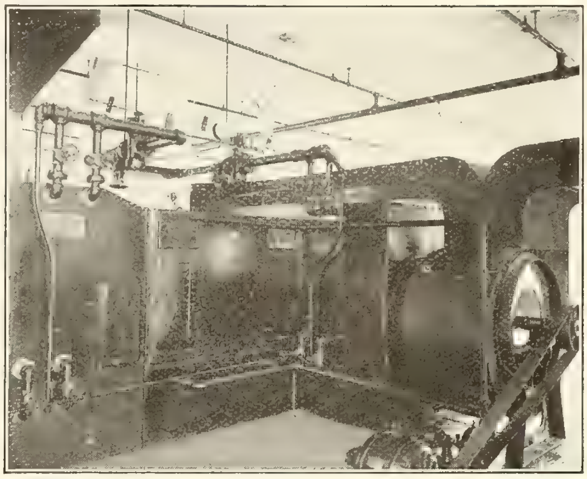

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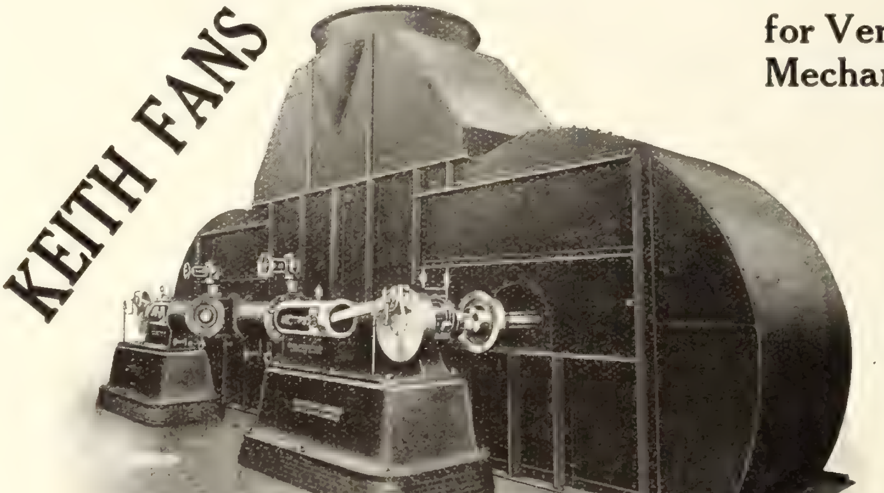

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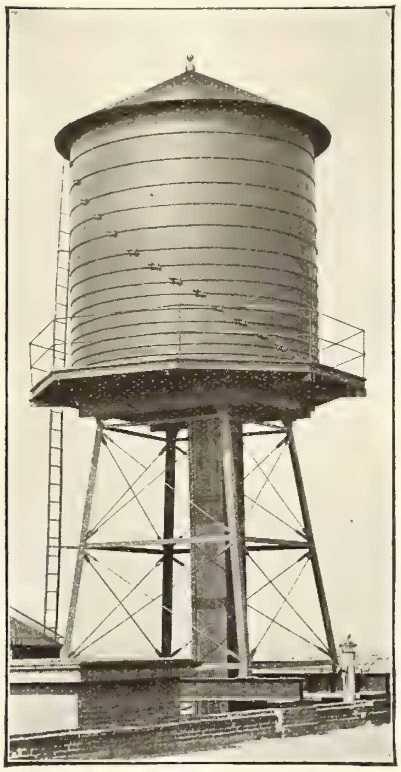

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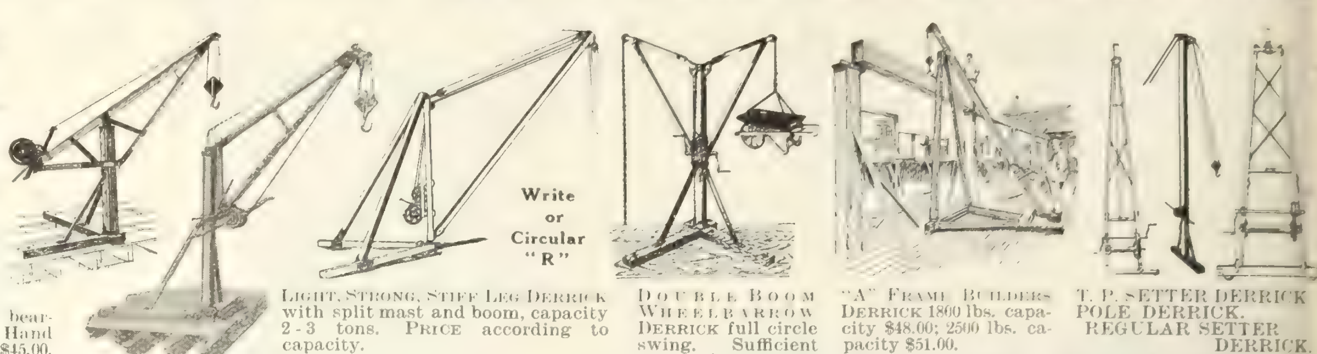

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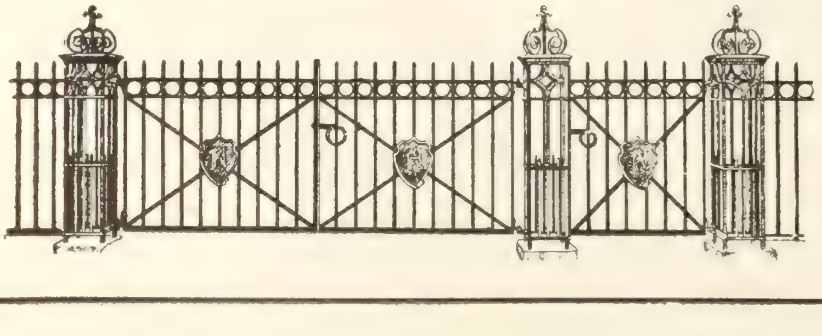

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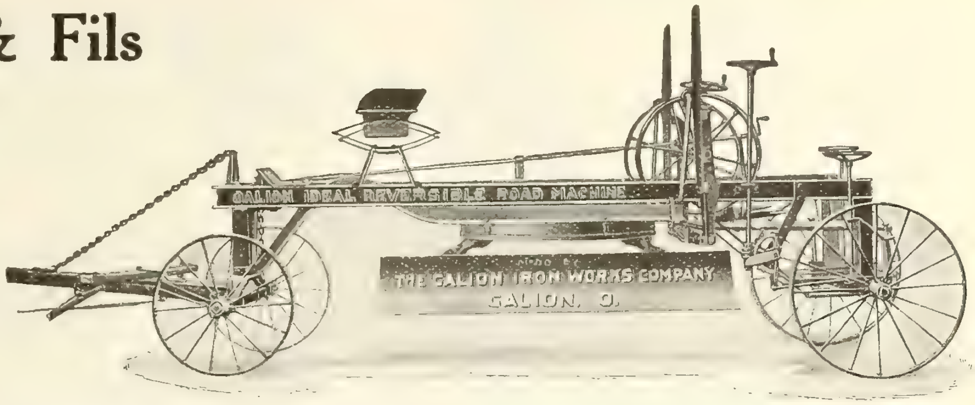
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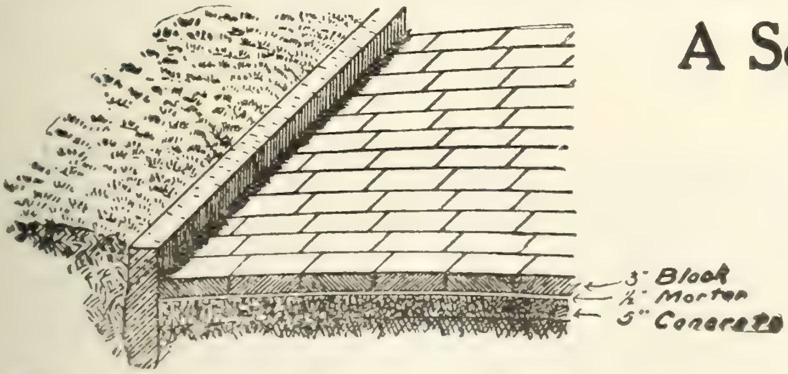

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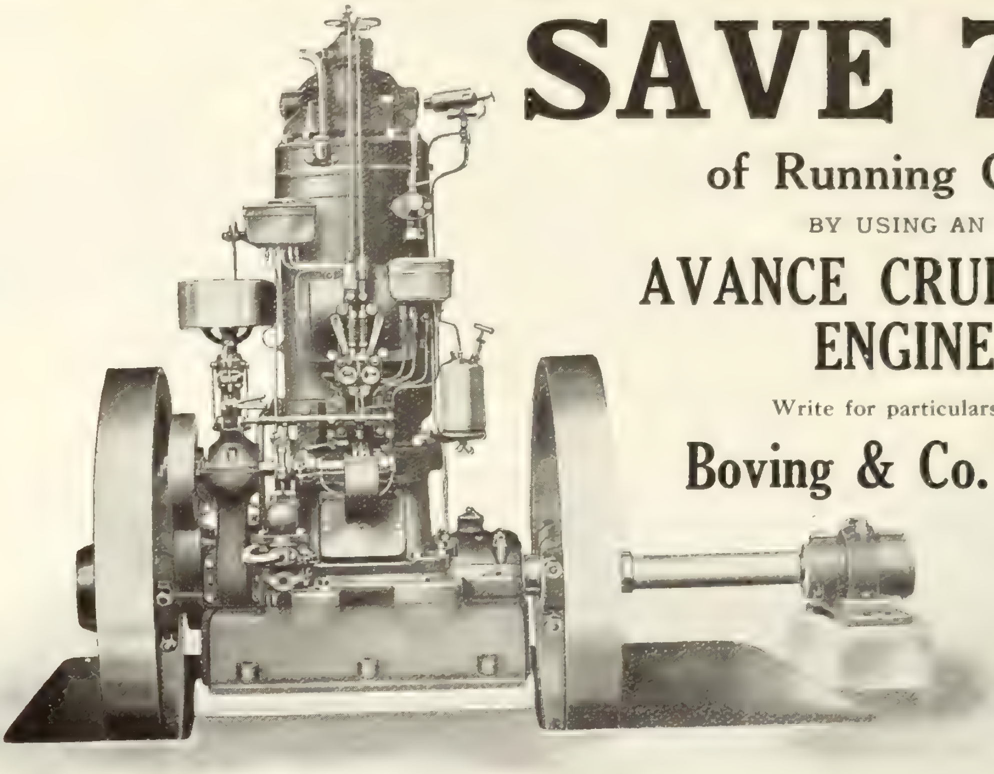

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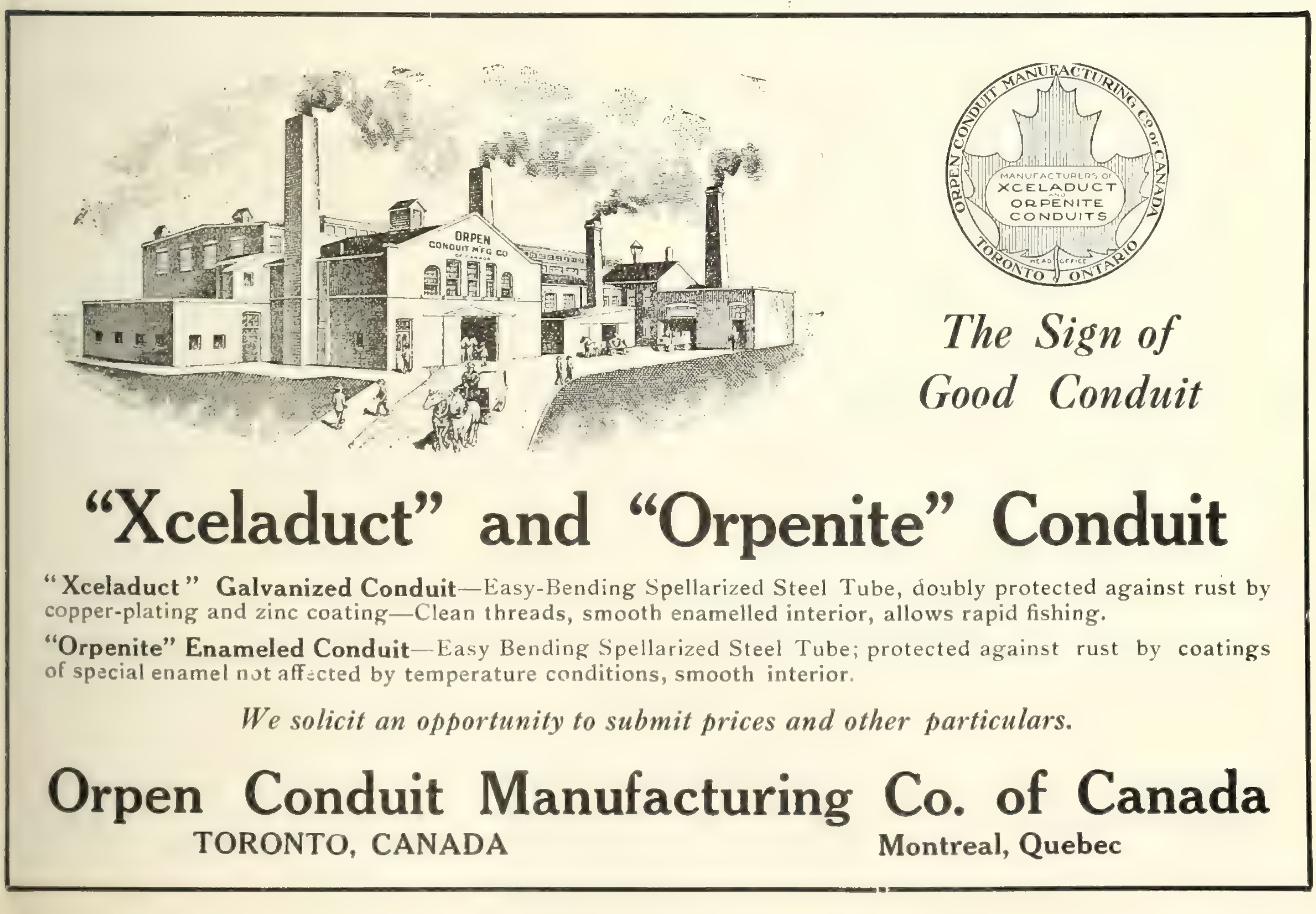

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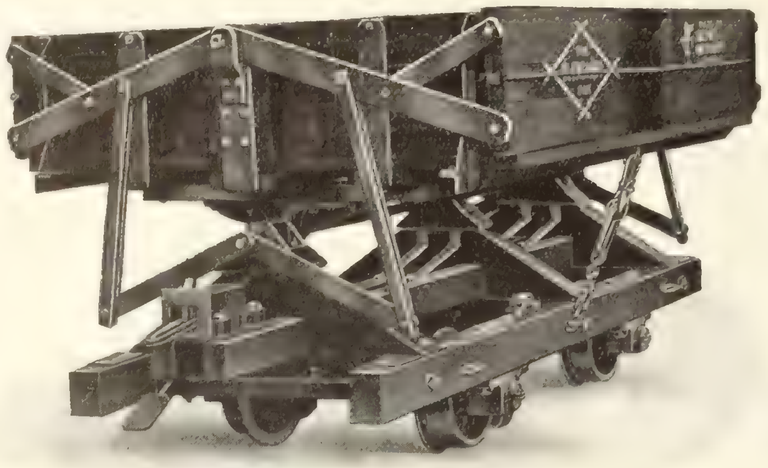

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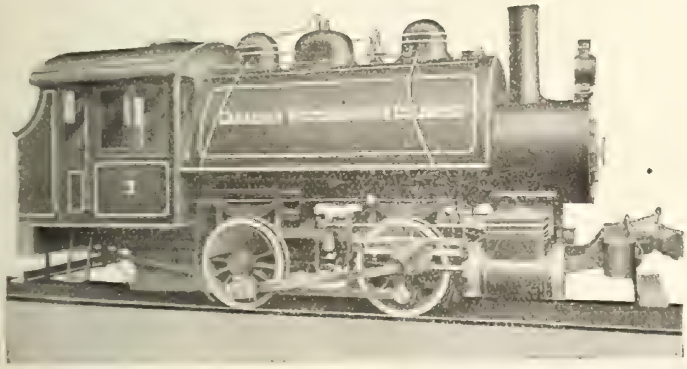

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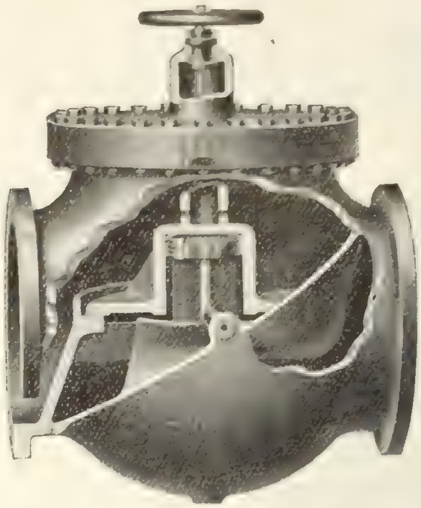

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Goodyear Air Hose will give good service under intermittent pressure.

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Each 50 foot length is tested to 200 pounds pressure and branded to that effect. The inner tube is of the highest grade NEW rubber, of uniform thickness and quality. It will give long service without hardening or cracking. The fabric is made rot and mildew proof by antiseptic treatment.

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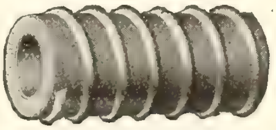

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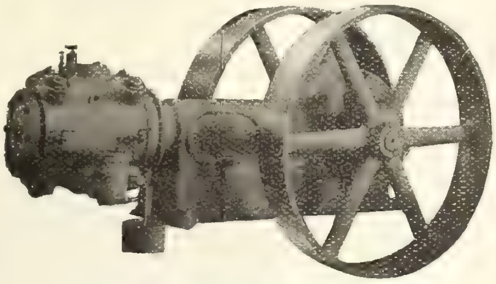
PRICE, CAPACITY, ECONOMY, AUTOMATIC OPERATION, WEARING QUALITY, TYPE—ALL MUST BE PROPERLY RELATED, IN THE COMPRESSOR YOU WANT.

PRICE

Can you afford the price of an air compressor? Rather, can you afford to do without compressed air in your plant? Would the biggest shops, foundries, etc., in the country be using compressed air if it were not profitable? And it will be equally profitable to you.



Class "NE-1" Compressor Direct Lift Valves. Note Enclosed Dust-Proof Construction.

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What you want is a compressor so designed and so built as to give it a moderate market price without any sacrifice of quality.

The pictures in this series of discussions show Ingersoll-Rand Compressors which measure up to this standard—the class "NE" power driven, and the class "NF" steam driven. They bring you the highest possible quality at the lowest consistent price.

The explanation of this paradox lies in two words—quantity production. Each part of these machines is an exact duplicate of a master-part. Each complete machine duplicates a perfect master-compressor.

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is the ideal protecter against moisture, because—

It insures uniformity of shade.

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It will prevent hair cracking on exteriors.

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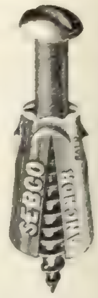

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in hard substances, such as brick, stone and concrete has been a stumbling block to mechanics for years. The old wooden plug method and the hot lead were never satisfactory. To-day SEBCO Expansion Bolts and Screw Anchors have taken their place, assuring quicker, neater and more substantial work. They are the only absolutely dependable means of attaching railings, gratings, iron doors and window frames, pipes, shafting, machinery, electrical apparatus and plumbing fixtures of every description.

You insert shield into a drilled hole. When the fixture is in place, tighten the bolt or screw which expands the shield or anchor embedding it firmly in the material into which it has been inserted.

SEBCO Expansion Bolts are for heavy work, the Screw Anchors for lighter work.

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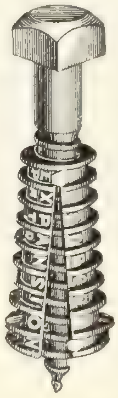

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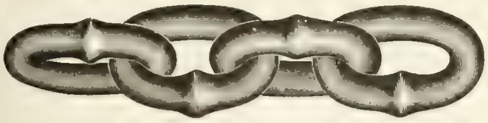

has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.

Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16″ to 3/4″ inclusive.

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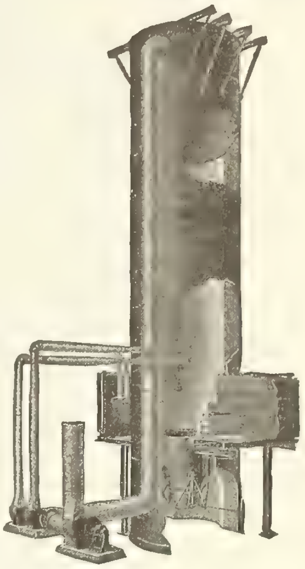

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We are the only company offering this service with the security it affords the buyer.

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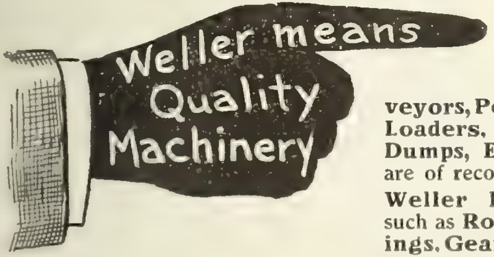

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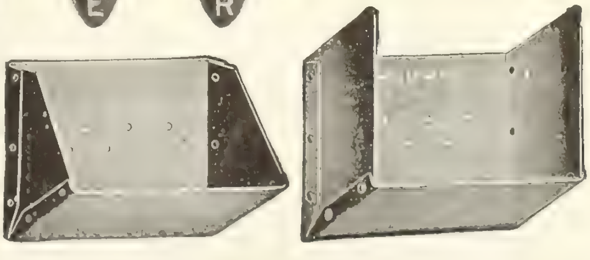

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Alphabetical Index of Advertisers
Page 16

Vol. 27 November 5, 1913 No. 45

Status of the Engineering Profession

SOME interesting operations bearing upon the status of the engineering profession are recorded on another page in the report of an address delivered on October 15th by Mr. Walter J. Francis, C.E., of Montreal, before The Engineering Society of the University of Toronto.

One cannot read Mr. Francis' paper without agreeing with him at least in part. In recent years public recognition of the engineering profession has not been commensurate with its responsibilities. The man in the street is not disposed to regard the engineer favorably. This is due largely to the fact that the municipal engineer is often made the scape-goat for inefficient and blundering administration. The consulting engineer is regarded too often as a bird of prey holding aloof until the municipality is so exhausted (by aldermanic mismanagement) that he can swoop down and get a picking. This condition of affairs is not overdrawn or highly-colored in either case—as witness the number of changes that have taken place during recent years in the leading positions offered by municipal engineering in Canada; as witness, also, the experiences of a dozen prominent engineers who have been engaged in a consulting capacity during the same period.

Whether, as Mr. Francis says, the work of engineering is too great and too comprehensive to be confined within the narrow limits of a "profession" is a matter that affords room for considerable dispute. Certain it is that there yet remains to be done much that would educate the public to a higher appreciation of the important position that the engineer occupies in the community. Canada is essentially a country of engineering enterprise and no body of men, professional or otherwise, possesses one-half the opportunity of the engineer. The question is: what immediate steps, if any, can be taken to bring the public to their senses? Public estimation seems to accord the medical man a place of his own—and yet his responsibilities are those of individuals: he deals with lives singly while the engineer is responsible for public life wholesale. It was an engineering oversight in the design of the Quebec Bridge that carried scores of workmen to their graves in the St. Lawrence, and it was an engineering oversight at Ottawa that resulted in one of the most fatal outbreaks of typhoid in the history of the country. Has the engineering profession any desire to impress these things upon the public?

Perhaps the public is just as much in need of a higher standard as the engineer. We should say, more so.

However these things may be, there can be no mistake in the policy of a higher standard of attainment for the engineer. We are inclined to think that something might be accomplished by raising the requirements of the universities.

Mr. Francis cites a number of men who have distinguished themselves in engineering after graduating from the University of Toronto, but, after all, the proportion is very small. How many have not passed out into oblivion, or, at best, into some walk of life that has only the remotest connection with engineering?

And so, while we pay tribute to the excellent work of the engineer—while we extol him above those professions which the man in the street may deem of the "higher" order—we believe that there is an opportunity in engineering for higher standards.

The leading men—and the leading men only—in engineering circles can hold their own with any other profession. We leave it to the reader to decide for himself whether the rank and file of engineering has the education and attainment, technically or otherwise, that entitle it to the distinguishing part that it should play.

The Proposed Municipal Engineering Organization

WE are pleased to note that a representative provisional committee has been appointed to draft out the constitution of the proposed Canadian Institution of Municipal Engineers. The list comprises: Mr. J. Antonisen, Street Railway Superintendent, Brandon; Mr. M. H. Baker, City Engineer, Prince Albert; Mr. Willis Chipman, Consulting Engineer, Toronto; Mr. G. T. Clark, City Engineer, Saskatoon; Mr. G. W. Craig, City Engineer, Calgary; Mr. A. Currie, City Engineer, Ottawa; Mr. F. L. Fellowes, City Engineer, Vancouver; Mr. G. D. Mackie, Town Engineer, Swift Current; Mr. T. Aird Murray, Consulting Engineer, Toronto; Mr. F. McArthur, City Engineer, Regina; Mr. H. H. Phillips, Toronto; Mr. R. Potter, Town Engineer, Battleford; Mr. J. B. Stirling, City Engineer, North Battleford; Mr. L. A. Thornton, City Works Commissioner, Regina; Mr. R. O. Wynne-Roberts (Convenor), Consulting Engineer, Regina.

It is noteworthy that eight municipal engineers, prominent in the profession, have identified themselves with this movement, and it seems particularly appropriate that the City Engineer of the Federal Capital should be taking a part.

It were an odious procedure to dilate upon the qualifications of individual members of the committee, but several of the above-named gentlemen who have consented to act on the committee are men of high technical attainment and wide experience in society work, and the best results may be expected from their labours.

It is of interest to note that our London contemporary, "The Surveyor," supports the views advanced in the editorial published on page 41 of our issue of October 17. Those who are interested in the movement may find in the following extract from an editorial article in "The Surveyor" something worthy of consideration:—

"The Canadian Society of Civil Engineers appears to us unsuitable for the affiliation of a purely municipal engineering body, as compared with the advantages to be derived from connection with the Institution of Municipal and County Engineers. The constitution of this Institution is such as would render the formation of a colonial "district" a matter of comparatively easy achievement; or, if the new society desired greater independence, some less formal method of affiliation could, no doubt, be devised. Such an amalgamation would be of mutual benefit, inasmuch as it would secure to the new society the benefit of the Institution's experience, and at the same time the older body would gain by the extension of its influence."

An Extension of Time that Points a Moral

It is gratifying to hear that the time for submitting competitive sketches for the new Government buildings at Ottawa has been extended to April 2nd, 1914. In an advertisement published in the "Tenders and For Sale Department" of our issue of September 3rd last, the closing date was given as January 2nd, 1914. This inadequate time allowance was the subject of a leading editorial article in the Contract Record of October 15th. The representations made would appear to have had some effect.

Here is a competition, of world-wide interest, for departmental buildings estimated to cost five million dollars. Surely the authorities are sufficiently alive to a sense of their responsibilities to give the people of this country the best brains that an undertaking of this magnitude will attract. The time extension given is none too great.

As we pointed out in the article, " 'Open' or 'Closed' Competition?" published in our issue of October 15th, Old Country architects have two other important competitions before them and it is quite unlikely that they will be able to turn their attention to the Canadian undertaking before the New Year.

It might be argued that such a prolonged period was not necessary—even waste of time, and that in any case there would be sufficient competition to produce a satisfactory design. Fallacies of this kind have been responsible for some of the greatest disappointments in structural undertakings, as a single example of which might be cited the old Quebec Bridge, the collapse of which was undoubtedly due to inadequate attention given to the details of design.

The new concrete sewer system of San Francisco, which has been in progress since 1908 under a $4,000,000 bond issue, is now nearing completion. The mains are entirely of reinforced concrete, lined with paving brick, and the system is a perfect example of modern drainage engineering. The largest main, 8 feet in diameter, runs from the county line via Mission street, San Bruno road, Eighth street, Sansome street, etc., to the Embarcadero, emptying at the foot of Grant avenue. An interesting feature is the overhead sewer of the Ocean View branch, a 3 by 4-foot conduit raised on tall concrete trestles to pass a low spot of ground. The entire system is built on pile foundations, enabling it to resist possible movements of the soil.

Forfeiture of Deposits

The Board of Education of the City of Toronto appears to have been permitting very loose practice in regard to the deposit cheques of contractors. It seems that contractors have not infrequently withdrawn their tenders after they have been opened by the Property Committee but before they have been finally passed by the Board. In this connection some interesting facts came to light at a special meeting of the Board of Education convened for the purpose of discussing the matter. The facts are such that we are entirely in sympathy with the suggestion to amend the by-law in such a way as to ensure the forfeiture of the deposit in the case of the withdrawal of the tender. We have often expressed disapproval of the exorbitant deposits required with tenders for public work, but that is another aspect of the question. Whatever the deposit required—if it be 50 per cent. of the amount of the tender—the conditions should be the same for all. The inequality of permitting a man to withdraw his bid after discovering —perhaps at the expense of a competitor—that he is too low, is apparent. If he be deemed sufficiently responsible to tender, the responsibility placed upon him, and which he assumes, should hold good throughout. If a man obviously made a mistake, an exception might be made by the authorities after a careful investigation of the case; but for the other conditions to obtain—conditions under which considerable malpractice is possible—is not in the best interests of the contracting community, even though it may enrich the few. The best way to improve contracting conditions throughout the country is to improve contracting ethics, wholesale.

Canadian Pacific Development

In the west the C. P. R. has, all told, two thousand miles of new construction under way. Before the snow flies over one thousand of the total new mileage will be completed. The double-tracking continues with the greatest energy. The ultimate ambition of Sir Thomas Shaughnessy is to see the entire system double tracked, a task compared with which the labors of Hercules were as easy as snapping a woolen thread. But the vast design can be carried out. It will be realized—if not in the time of Sir Thomas, in that of his successor. Sir Thomas has put his hand to the work, however, and much of it will be completed before he lays down the reins of office. It is not remembered, perhaps, that much of the original road has been re-made, as part of the policy of consolidation for which Sir Thomas was responsible. New steel, new roadbed to give stability, new bridges—these features have been part of the programme. A vast outlay has been necessary, but the original system, hurried and spasmodic, has been almost wholly wiped out—replaced with modern features. To double track over four thousand miles of the main line would be an achievement worthy of the heroic ages. But it can and will be done within the next twelve or fifteen years.

The Application of Business Methods to Construction Work

THERE has been a great change in the methods used by successful contractors due to a change in conditions under which the work is now done. Successful contractors no longer "guess" the quantities, but study each contract and obtain complete data relative to it before submitting their bids. The following article has been abstracted from a discussion of this subject by James L. Stuart, Contracting Engineer, Pittsburgh, Pa., in the September issue of the Journal of the Cleveland Engineering Society.

Perhaps there is no business which responds more quickly to what is termed "business methods" than does the average piece of construction work. Certainly, there is no business with more diversified interests and trades connected with it than the modern structure, be it railroad terminal, factory, office building, hospital, or hotel.

It has not been more than twenty years, at most, since the construction of buildings was left entirely to practical men who had themselves worked up from positions as artisans or laborers to positions of leadership in constructional lines. Some of these leaders in the past were most talented and even brilliant, but they did not bring with them into the business, except in rare instances, the methods of the trained engineer or the progressive business man, their principal assets being nervous force, executive ability and practical knowledge of the building trades. However, as building construction became more complex and of greater magnitude, the necessity of trained men who understood the engineering problems and who appreciated the application of business methods necessary to bring "order out of chaos" became more apparent, and now both engineering knowledge and modern business methods are most necessary to get proper results as to economy and quality in all of the larger undertakings.

Methods and Organization

In order to successfully construct a building, it is necessary that one should anticipate each step in the progress of its development and outline the various steps from the time the drawings are received from the engineer or architect until the building is turned over completed to its owner. The first step in such a process is to make a complete estimate of the cost of the structure from the drawings and specifications, including every item mentioned in the specifications or shown on the drawings. In addition to this there are other small items which are not mentioned in the specifications, but which are necessarily a part of the cost of the building and should be included as such. Under the latter are such items as the cost of administration, liability insurance, temporary buildings, expediting, tools and machinery, and numerous smaller items. These estimates of cost were originally made up by the contractors themselves and were but approximations as compared with the present method of compiling them. In the latter method every advantage is taken of the prevailing market prices when the estimate is made, of the conditions of the labor market, the physical condition under which the work is to be done, and the season of the year. In a properly prepared estimate the unit prices should vary on each individual piece of work, whether figured at the same time or not.

After the estimate has been made of the total cost of the building—and I think an estimate should be made of every building whether the work is to be let on a lump sum contract, cost plus a fixed sum, or on a time and material basis—the next step is to make up a time schedule allowing fixed periods of time for the completion of each part of the building. This must be done most carefully, as on this schedule is based the dates of completion of the different contracts for material and the contracts with sub-contractors for furnishing such portions of the work as are not to be executed by the general contractor's force in the field. This time schedule is made after a thorough study of the drawings, the site of the new project, and a familiarity with the estimate which, as I have said before, gives the quantities of the different kinds of material and assists in estimating the length of time required to complete the various stakes of the work.

After the estimate and the time schedule are completed and the contracts for material and labor have been entered into, the real work begins.

A dozen or more sets of drawings are procured from the architect or engineer, a copy of same placed on file in the main office of the builder, one copy sent to the job office and the others distributed among various sub-contractors who have to make up their shop drawings and prepare certain materials to be later installed in the building. A careful record must be kept of these drawings and to whom they are addressed and the date on which they are sent. While the various departments of the main office keep thoroughly in touch with the work in the field and the material in preparation, at this point, if the work is of sufficient magnitude, it is turned over to one particular member of the contractor's force, preferably a trained engineer, whose duty it is to keep in thorough and constant touch with all the drawings and all of the correspondence. He also has access to the files of the sub-contractors, contracts, contracts for materials, the original estimate and all other information pertaining to that particular piece of work. It is then his duty to follow up the sub-contractors in the preparation of their shop drawings, the submitting of the same to the architect for approval, the ordering of materials by the sub-contractors, and the progress being made through the fabricating shops and mills. This following-up process is part of his daily routine and from time to time reports are made to the superintendent in charge of the actual field work to enable him to know when the material is to be received, when the sub-contractors will have their men and material on the job, all of which enables him to shape up the field work so that certain portions of the building will be ready for certain sub-contractors at a fixed time. It is also his duty to keep track of the change orders and the changes made in the construction of the building, whether it be an addition or a subtraction. You can readily understand how necessary it is that all sub-contractors should be advised of changes, for often when they are conceived in the mind of the owner, their interference will be more far reaching than he or anyone else anticipated.

A proper executive organization to do the field work is most important. It is far better to have too much assistance in the field than too little. First, there must be a superintendent who possesses rare abilities as an executive, who understands drawings and specifications thoroughly, who has had wide experience in building work and who has a knowledge of the different trades so as to be able to anticipate far in advance of his requirements. Above all, he should be able to create in those working under him, including the workmen employed in his department, and foremen and workmen of the different sub-contractors, an enthusiasm in their work, a desire to see it grow steadily, and to do it in the most substantial manner possible. If the work is of sufficient magnitude he should have an assistant superintendent, or possibly two or three of them, a large enough clerical force to do the timekeeping, and to keep an accurate cost record, and he should segregate the cost of the additional work which was not originally provided for. All of this work, if permitted to lag for even a day, becomes most complicated, and if not accurate, its value is entirely destroyed. In addition to this it is the duty of one of the clerks to send to the main office each day an accurate and concise report of what has been done during the day, the state of the weather, temperature, etc. As the building nears completion, work in the main office lessens, and it is usually an excellent idea to have the man in charge of the particular job in the main office to get in actual touch with the building and to assist the superintendent in picking up the loose ends in getting each trade completed as rapidly as the progress at the building will permit. This man (from the main office) is thoroughly familiar with each trade, knows just what changes have been made in the work, has a splendid knowledge as to how long it will take each trade to complete its work, knows the difficulties under which each has been laboring and can finish his "following-up process" from the field more intelligently than if he were to remain at the main office.

Cost

The cost of a piece of work is always of interest. The estimating department has access to the daily and weekly cost reports which are compiled in the accounting department, and from these they can compare and report to the proper person whether or not the work is being done each day or each week within the amount allowed for the same in the original estimate. If the work is not being done within this cost, and if the unit prices vary considerably from day to day, an investigation is at once made at the building to ascertain the reason for such fluctuations, to advise the superintendent of the discrepancy, and to see if ways and means cannot be found to bring the cost within its proper allowance—the estimate having been based on the cost of similar work under the same conditions, the proper average should not vary greatly from the amount allowed in the estimate.

The two following examples serve to illustrate the methods which were used in connection with the erection of a large manufacturing plant and a modern hotel building:

Construction of Large Manufacturing Plant Near Pittsburgh

Some time during the latter part of May, 1910, the manufacturing plant just referred to, covering approximately 15 acres, was almost totally destroyed by fire. All of the buildings were brick, some with wooden trusses and slate roofs, but the greater number were constructed with steel frames and cement tile roofs. The fire in and around these steel structures was so intense, however, that most of them collapsed of their own weight, and were only a mass of twisted steel, broken cement tile, brick and mortar, all of which it became necessary to remove in order to reconstruct the plant. We first received orders to clear the site, and subsequently were instructed to proceed with the reconstruction of the buildings. Fortunately, the power plant had not been greatly damaged, and, as a large portion of the plant had been electrically driven, we were able to get sufficient current of high voltage to use in cutting up, or, I should say, burning apart the collapsed steel frame, all of which was so badly damaged that it was loaded on cars and sold as junk.

After the site was cleared we began excavating for the new foundations, starting on the buildings which would be required first and those in which the greatest amount of machinery was to be installed. This scheme was followed so as to enable the entire plant to be completed at about the same time. It was the desire of the manufacturing company to commence manufacturing about the first of October, or earlier if possible. The key to this particular situation was to get the steel, of which there were about 4,800 tons. After consultation with the operating and executive departments of the manufacturing company, the order in which the different buildings were to be completed was decided on and the dates were fixed for the delivery of the steel for each building and were included in the schedule for the completed buildings. The structures were quite simple, similar to most of the modern factory buildings, but in order to live up to our schedule we knew we must keep continually in touch with the bridge company and see that nothing was permitted to lag or be left undone in order to make the deliveries as they promised. Our "expediter" was put in charge of the job at once and during the first month spent most of his time between the order department of the bridge company and the steel mills where the plain material was being rolled. After the last of the orders for the plain material had been sent to the rolling mills he devoted his time more particularly to the drawing room of the bridge company and reported daily just what progress was being made in designing, detailing and checking, the number of draughtsmen employed, and the progress made on each building. At times it was found that the checking department was overbalanced by the detailing department and that the designing department was not turning out sufficient work to keep the detailers and the checkers busy. This was adjusted by numerous meetings between the bridge company, the executive department, the manufacturing company, and ourselves. I might say, at this point, that the principal requisites of an expediter are, a thorough knowledge of the work to be performed, a pleasant personality, and the ability to interest the people who are actually doing the work—in this case, the men who made out the mill orders, the draughtsmen, the different foremen in charge of the rolling mill, and the foremen in the fabricating shop. All should be made to feel that their interests are parallel and that what is good for one is good for all. As soon as the drawings for one of the buildings were completed, we saw that this work was put in the shop at once, where someone had already attended to the delivery of the plain material, and that no time was lost in fabricating and shipping the same.

At times during the preparation of the drawings it was found necessary to urge the bridge company to employ additional men in all departments. This required considerable tact and force as, naturally, the heads of the different departments do not care to have their routine changed or, as they express it, "meddled with." This phase of the difficulty can be overcome only when it is possible to arouse sufficient interest in that particular piece of work. When the work was started our expediter received from the rolling mills, from which he knew the steel was to be furnished, a list of their daily rollings, and we saw to it that certain materials were gotten in on the dates at which the first rolling of that particular material was made. This saved considerable time, and we were able to get all of the plain material delivered before the shop drawings were entirely completed on the first building. The meetings between the heads of our department and the heads of the bridge company were most useful. Our expediter was usually on hand, and we were able to discuss the progress made since the last meeting, the condition of the work in the draughting room and in the shop, and to devise ways and means for overcoming any obstacles which had arisen, due either to lack of men or to want of materials.

The steel was erected as fast as the work was gotten out of the mill, fabricated, and delivered. We insisted on its being fabricated in sequence so that any materials delivered at the building could be immediately put in place. It had been previously decided at which end of the building the work would commence, and our superintendent in that field was advised of this fact and was also kept in thorough touch with the progress of the different stages of the steel. As the cars of steel were loaded and shipped out, they were put in the hands of the tracing department of the manufacturing company, and our own tracing department as well, and shipments were followed up until they were finally landed at the site. Our tracing department had, prior to this time, made the acquaintance of the different employees of the railroad through whom the records of the movement of the cars were to pass, as well as those who had direct charge at the transfer points. After the steel had been delivered the rest of the work was a mere question of brick, mortar, sand, gravel, cement, window frames, sash, roofing material, and sufficient workmen. Of course, there were large quantities of all these materials required and in order not to delay the work it was imperative that certain amounts of the same be delivered and put in place prior to the delivery of the steel.

Statler Hotel, Cleveland, Ohio

The same general method was applied to the construction of the Statler Hotel, except that the work was much more complicated and required many more details. There were approximately 90 sub-contractors and material men in and around the building from almost the day it was started until its completion, and it required a great deal of patience, perseverence and hard work to get the different trades to dovetail into each other throughout, so that those who did the preparatory work would finish and leave in time to permit the finished material to be erected in a proper and substantial manner. On the Statler Hotel we found it necessary from about the first of June until a few days before the building was turned over to Mr. Statler, to insist on daily meetings of all of the sub-contractors on the work, together with the architect's representative and others interested in the building. At these daily meetings each trade was taken up separately with the principal representative of that particular trade and the representatives of all the other trades present. He was questioned regarding the progress of his work and was told to state whether or not he was being retarded by any of the other trades. If it was found that his work was being hampered he was made to state explicitly and in detail to what extent and how.

The advantage of having all of the sub-contractors together at one time can readily be seen, as it eliminated innumerable quarrels between the foremen of the different trades and many misunderstandings which invariably arise due to the fact that the workmen and foremen are not always capable of expressing their troubles in an intelligent manner and, when they are busy, many times do not take the trouble to express themselves at all. It was rather hard to get them to continually attend these daily meetings, as they were held in the evening after they were supposed to be through with their work. We always tried to make the meetings as pleasant and as short as possible and never permitted ill-feeling to exist between the several trades arising from the discussions at the meetings. A typewritten report of each meeting was posted on the general bulletin board so that each of the sub-contractors would have access to the same during the following day.

The following points were brought out by Mr. Stuart in the discussion of the original paper:

Lump Sum or Percentage Basis for Contracts

If we can get contracts under reasonable competition, we much prefer to do work on the lump sum basis, as the work is then entirely in our hands and whatever we can save by any unusual attention or ingenuity is ours. However, if there is a chance that the competition will not be fair, and we are after the job pretty hard, we are glad to take it on a commission basis. A great deal depends on conditions. If the contractor is thoroughly honest, and when I say "thoroughly honest" I mean if he has real conscience, then it seems to me that a commission basis is the best on which to operate from the standpoint of the owner, because he gets exactly that for which he pays.

When we take work on a commission basis, and we do a great deal of that work in Pittsburgh, we make up an estimate of the actual cost of the work and tell the owner how much he is likely to expend. We do this for two reasons: One is that we do not want our organization to get into the habit of making any difference whether it is on a commission or a lump-sum basis. If you give the owner an estimate of his building, then it is everybody's purpose to keep within the estimate. The other reason is that we think it is only fair that the owner should know what the building is to cost, and we sometimes guarantee that the work will not exceed a certain maximum sum.

The owners should be satisfied even though it may be a little more expensive to have the work done on a commission basis, as it saves them in other ways. For example, it gives the owner a chance to make changes and to have the work done in just the way he wishes, so as not to interfere with his business. Personally, I do not think it costs any more to do the work on a commission basis, especially if the contract covers several buildings or a long period of time. We now have three contracts on a commission basis which are yearly contracts, that is, unless they are cancelled before the close of the year they carry over to the next year.

I think the principal objection to percentage work is that the owners do not sufficiently trust the contractors. I know many honest contractors, but just as in other business there are some who are not honest. This is not generally true of engineers, as statistics show that in the army and navy corps few engineers have proved dishonest.

We sometimes let some of the work to sub-contractors on a commission basis, but never when the work is of such character that it must be prepared away from the building, such as mill work, steel work, ornamental iron, etc. We have done our own plastering work, but we do not find it very advantageous, because most sub-contractors look after the work themselves as foremen. Fireproofing, painting and other trades are usually sub-let. Most people agree that to get some one who knows how to do it is worth the profit they pay to the contractor.

Value of Creating Interest

It is essential that sub-contractors and all others connected with a piece of work shall take interest in facilitating the work. Little progress can be made unless everyone is doing his part. We sometimes go so far as to stimulate interest among those furnishing the materials. For example, some one may be sent out to meet the superintendent of the brick plant, from whom the bricks were bought. In fact, our representative may meet the man who writes out the bills and also the man who loads the cars. To be more specific, during the construction of the Statler Hotel we had a man at the stone quarry who saw that the stone was shipped just as we needed it; he stayed there two or three months. The lower courses were shipped first, but even then we paid a large demurrage.

Detailed Estimates

Estimating is becoming more and more standardized. A great many estimators figure work on the same basis. The estimating in Europe is done by professional estimators, or surveyors, as they are called. In England one surveyor will make an estimate and give it to the different contractors. I think it has been attempted here a number of times, but it does not seem to be satisfactory.

In making our estimates we obtain the price of cement delivered; we get the cost of the aggregate; we obtain from the specifications the amount of cement required and the ratio of the concrete mixture; we figure minutely just what the material is going to cost; and we then add the cost of the labor. For the reinforcement, we get the prices per pound, and then compute the amount of reinforcement required for the entire job. The principal element of variation in reinforced concrete is with the wooden forms. We figure the number of feet of lumber which will be required for the framework for the entire job. We do not try to compute the formwork at so much per yard, as it will vary on different buildings, depending on the thickness of the slab, and on other details which vary with every job. It ought, theoretically, to vary almost every day.—Engineering & Contracting.

The Port Moody Sand and Gravel Company's Plant near Vancouver, B. C.

By S. A. Lake

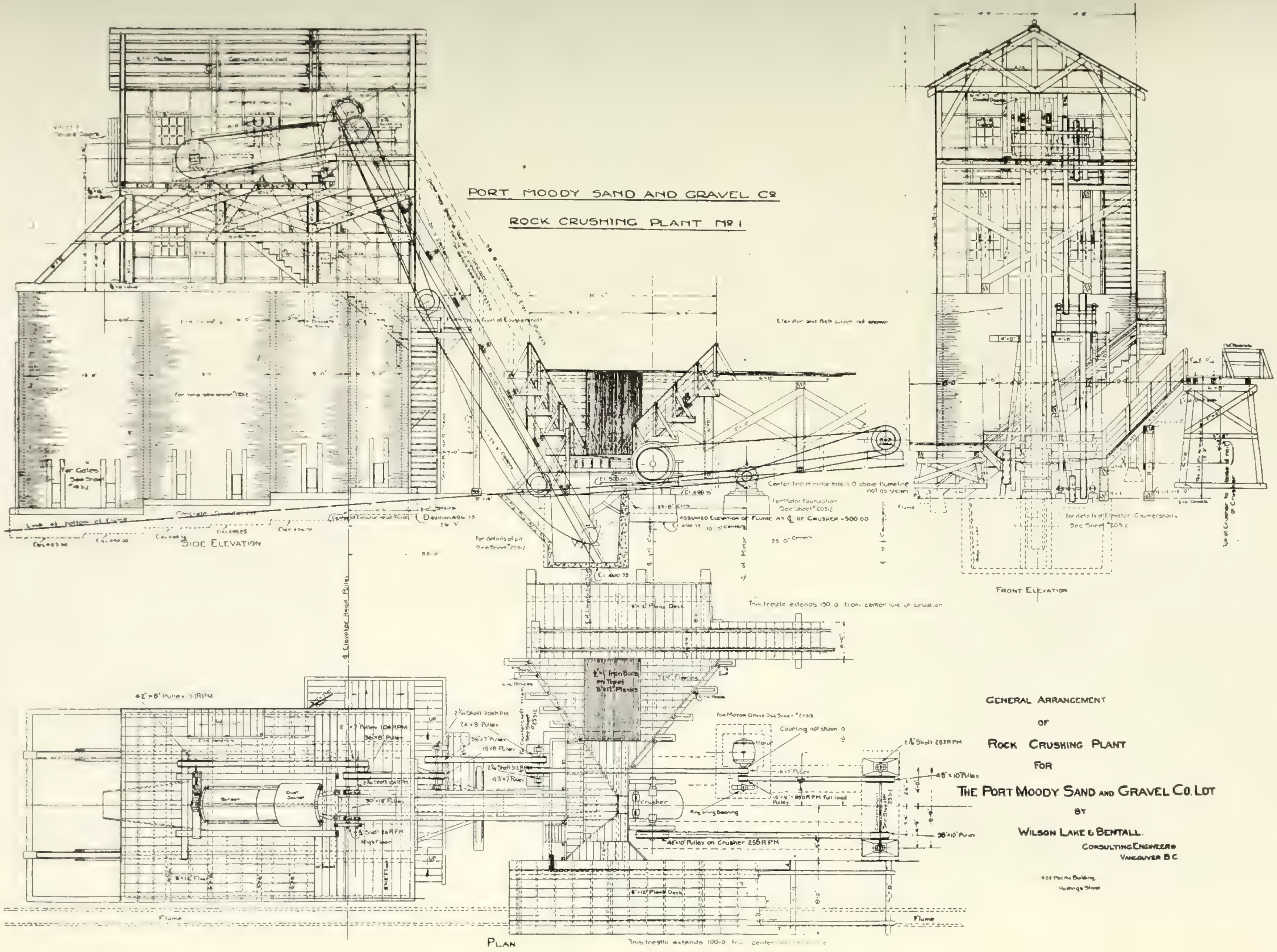
THE gravel pit and plant of the Port Moody Sand & Gravel Company are situated on the north shore of Burrard Inlet, about ten miles from the city of Vancouver and close to Port Moody. The property comprises about seventy acres, situated 3,500 feet from the beach and about 300 feet above sea level, and the company has acquired a right of way 66 feet wide from the pit to the beach, where the screening plant and storage bunkers are located.

The water from a creek above the pit is utilized for excavating and conveying the gravel to the beach, the right to take 250 miners inches from the creek having been acquired by the company. The fact that this amount is not available in dry summer weather made it necessary to investigate other sources of water supply, a reservoir site was located close to the property and the preliminary work for building a dam carried out. After consideration this scheme was abandoned, the determining factors being the uncertainty of water supply and the loss from evaporation in a reservoir having a large surface area compared with its capacity. It was ultimately decided to use sea water, a multistage turbine pump being installed at sea level for that purpose.

The material in the pit contains many boulders from six inches to between two and three feet in diameter which it was impossible to convey to the beach by means of the flume, so a plant was installed at the pit to reduce these. This plant consists of a rock crusher, with storage bins arranged so that the product can be discharged into the flume and conveyed to the beach. The storage bins are emptied at night, in order that the gravel sluicing shall not be interfered with. A derrick in the pit handles the larger stones, delivering them to a bunker from which they are carried to the crusher in dump cars. Stones from six to ten inches in diameter descend in the flume until the crusher is reached and are there separated by means of a grizzly from the smaller gravel, which continues its course to the washing and screening plant at the beach.

Flume.—There is about 3,500 feet of flume on a 7½ per cent. grade. The flume is constructed of lumber in the usual manner, 18 in. wide and 18 in. deep, blocks end grain on and 6 in. thick being used to take the wear. Before reaching the beach the flume crosses the tracks of the Canadian Pacific Railway (which here run through a cut) by means of a timber truss bridge. A second bridge at this point takes care of the 16 in. woodstave pipe from the pumphouse.

Screening Plant.—The screening plant is arranged with duplicate screens and the flume is divided just before reaching the plant so as to turn half the water and gravel into each set of screens. At the first screens all material over two inches in diameter is rejected to a storage bin, which feeds direct into the crusher of a second crushing plant built alongside the screening plant. The product is elevated to a screen afterwards being stored in bins below for shipment. Subsequent screens separate the two-inch and one-inch gravel, and the water and sand then pass to two automatic dumping tanks, which separate the coarse sand. The overflow from these tanks passes through a sedimentation tank where the finer sand is deposited. Thus two grades of gravel and two of sand are obtained in the


PORT MOODY SAND AND GRAVEL Co
ROCK CRUSHING PLANT No 1
SIDE ELEVATION
FRONT ELEVATION
PLAN
GENERAL ARRANGEMENT
OF
ROCK CRUSHING PLANT
FOR
THE PORT MOODY SAND AND GRAVEL CO. LDT
BY
WILSON LAKE & BENTALL.
CONSULTING ENGINEERS
VANCOUVER B.C
Elevator and Belt cover not shown
Assumed Elevation of Flume at ℄ of Crusher = 500.00
This trestle extends 150.0 from center line of crusher
This trestle extends 100.0 fr. center
Coupling not shown
Crusher
Screen
Dust Jacket
42"×10" Pulley on Crusher 256 RPM
Flume
Flume

General view of screening plant from discharge end of conveyor belt.

following proportions. Fine sand 20 per cent., coarse sand 40 per cent., one-inch gravel 25 per cent., and 2-inch gravel 15 per cent.

The storage bunkers, on top of which the screens are placed, have a capacity of 4,000 cubic yards for all sizes, and the discharge openings are arranged above a belt conveyor running at a speed of 300 feet per minute and with a capacity of 180 cubic yards per hour. A short conveyor is run under the rock bunkers and connected across by another to the main loading conveyor, running out rom under the gravel bins. This latter conveyor is 427 feet, centre to centre, and discharges through an adjustable spout into scows at the end of the wharf.

Pumping Plant.—The pump house is situated at the end of a pier some 300 feet from the shore, constructed for the purpose of carrying the pipe out to deep water. The house contains a multistage turbine pump, manufactured by Allen & Sons, of Bedford, England. This is direct connected to a Westinghouse motor 450 h.p., three-phase, 2,200 volt, running at 850 revolutions per minute, as well as the necessary switchboard, valves, by-passes and priming jet. The pump is guaranteed to deliver 7.5 cubic feet per second against a pressure of 165 pounds per square inch.

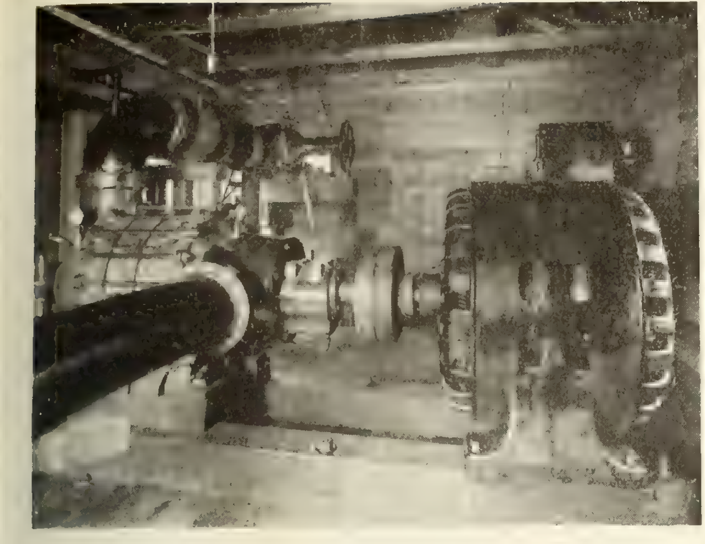
Electrical energy is supplied by the Western Canada Power Company, which has erected a sub-station on the site of the plant. The motors used on the plant are as follows: 450 h.p., 2,200 volt; 40, 35, 25 and two 10 h.p., all 220 volt, three-phase induction type.

This plant has a capacity of 500 yards of gravel and sand and 320 yards of crushed stone per 10-hour day. The crushers are Hadfield's Jaw type. The gravel screening machinery was supplied by Meese & Gottfried, the conveyors by the B. C. Equipment Company, of Vancouver, and the conveyor belting by the Canada Rubber Company.

The work was done partly by contract and partly by day labor employed by the owners. The consulting engineers were Wilson & Lake, 221 Pender Street W., Vancouver.

Great care is used to get a clean product by con-

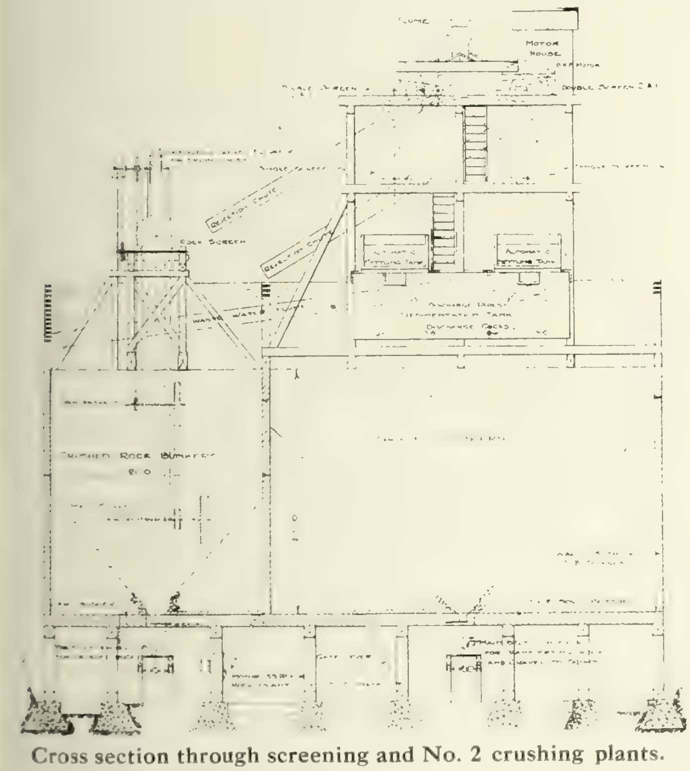
View of screening plant looking towards the water.



Interior of pump house.

siderable washing in the pit before sluicing the gravel into the flume.

Some trouble was met with in the settling tanks, as the sand formed a hard bed during each stop and required digging out before starting up. This was overcome by arranging tipping beams to the tanks so that they can be completely emptied by one man at the end of each run. The use of the automatic tanks in combination with the sedimentation tank has proved a success in obtaining a coarse sand for concrete and fine sand for plastering, etc.



Cross section through screening and No. 2 crushing plants.

The general design and arrangement of plants can be understood by reference to the accompanying cuts and drawings.

A record in boring the Mount Royal tunnel of the C. N. R. has been made. The men have bored 418 feet per month, which, says Mr. T. S. Brown, the chief engineer, is two feet more than has been previously done.

Brick Paving Construction in Baltimore[*]

THE first rick pavement laid in Baltimore was constructed about 1892 on St. Paul Street between Biddle and Preston. It was laid on a 4-inch base of concrete and a sand cushion anywhere from ½-inch to 3-inch in thickness. The brick was about the same size as the ordinary building brick, wire-cut, with straight edges, and of red shale. Instead of laying the courses at right angles to the curb, they were laid herringbone fashion, the most expensive way to lay a pavement. Sand was used as a filler. After giving 21 years' service, one half of the block was removed; the other half is still in fairly good shape. I cite this to show that even in the early stages of brick construction good work was sometimes accomplished.

We next used re-pressed brick, with lugs; in 1911 23 miles of vitrified block—some of poor construction, some fair and some excellent—had been laid. From January 1, 1912, to September 1, 1913, we have put under contract about 243,000 square yards and have completed 182,000 square yards. Some of this work is on very heavy traffic streets, most of it withstands medium traffic, while a small portion of it is alley work. Probably 5 per cent. of our brick so far is on a 4-inch base, with 95 per cent. of it on a 6-inch base.

Present Principles of Laying Brick Pavements

While we do not use a template in finishing our concrete, the contractor is required to make it of such consistency and to ram it in such a way that it presents an even and smooth surface. On a 6-inch concrete base stone passing a 2½-inch screen, and on a 4-inch base stone passing a 1½-inch screen is allowed to the extent of 20 per cent. of the total mass; but in no instance must the longest dimension of any stone be more than one-half the thickness of the concrete base.

Our specifications first required a compressed sand cushion 2 inches thick, but, to overcome a tendency to exceed this on the part of the contractor's foreman and the city's inspector, we finally reduced our cushion to 1½-inch, and, owing to the smoothness of our concrete, there is very little variation from this depth. We find that the thinner layer is more easily compacted, an important detail in the proper construction of vitrified block pavements. When the sand cushion is not compact and firm the grouting is more apt to break and jump out, due to the vibration of the brick under traffic. Furthermore, the rumbling sound so frequently noticed from teams passing over a brick pavement is due in a large measure to this lack of compactness. I recommend a loamy sand preferably with 10 or 15 per cent. of loam, rather than a perfectly clean material.

The most practical way to determine whether or not the sand cushion is sufficiently firm is to step on it evenly but firmly, gradually throwing the entire weight on it. If there is a decided imprint, the cushion should be re-rolled.

Brick should be hard (not so hard as to be brittle, however), well and uniformly burned, and free from warps, fire-cracks and other defects. Uniformity is extremely important. A street composed of uniform brick will wear evenly and will always present a good appearance if otherwise well constructed. The breaking of joints is another important item and when cutting brick to fit in next to the curb the cut end should be placed away from the curb rather than against it to give a better finish.

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[*] Abstract of Discussion by R. Keith Compton, Chairman, Consulting Engineer, Baltimore Paving Commission, before the Third American Road Congress at Detroit.

In my judgment it is a great mistake to lay the brick too close, just as it is to have too loose paving. If laid too close it is impossible to obtain a sufficient amount of grout in the end joints. If laid too loose, however, while rolling the brick will rock and the sand is apt to come up into the joints. This latter fault is a very common item and should be guarded against to the limit. While the brick are being rolled the inspector should carefully follow the procedure, and if the sand cushion is coming up the brick should be immediately removed and the sand cushion restruck; if necessary, re-rolled. The appearance of more than ¾ inch depth of sand in the joints seriously obstructs the admission of the cement grout.

Application of Cement Filler

I am a firm believer in a cement-filled joint rather than a bituminous-filled joint for brick pavements. Cemented joints protect the edges of the brick and give a monolithic construction, while bituminous-filled joints are deficient in these respects. Two years ago I saw bituminous-filled streets completed in the most workmanlike manner and the streets left with a good even surface. Today the brick have rounded on the edges, and the surface has become decidedly uneven, the brick having shifted and floated on account of the bituminous-filled joint.

Some years ago we tried a cement filler mixed two of cement and one of sand but found this too brittle and returned to the 1:1 mix. If this filler is mixed and applied as outlined in Mr. McCleary's paper (see abstract Contract Record, p. 55, October 22, 1913), no trouble should be experienced, but it is imperative that the minutest detail of the selection of the sand and cement, the mixing, the application, and the covering with sand after the filler is otherwise completed, be complied with. The slightest deviation from one of these details is more than likely to cause trouble.

It is bad practice to follow too closely the application of the filler with the sand cover. The sand cover can only be used to protect the cement filler from the hot rays of the sun or from frost. It is very important that two or three hours should elapse between the time that the filler is completed and the time when the sand cover is applied, as a too early application of sand will not only cover up slack joints but may seriously weaken the cement filler.

As is well known, only the side joints next to the curb are necessary. Every precaution should be taken to have these joints free of foreign matter so that the pavements will have the full advantage of a clear joint filled from the top to the bottom with either a good bituminous filler or the patented "Elastic" joint.

The following thicknesses of joints next the curb are recommended: On streets between 30 feet and 50 feet in width, 1¾ inches; on streets between 20 feet and 30 feet 1 inch; on streets between 10 feet and 20 feet, ¾ inch.

If all of these details are strictly complied with, there will result a street possessing durability, ease of traction and a pleasing appearance; further, it will have a sanitary surface and will necessitate only a moderate maintenance cost.—Engineering Record.

Revew of Concrete as a Fire-Resistant

IN a paper recently read before the Boston meeting of the American Society of Mechanical Engineers, G. E. Fisher, Engineer of the Arkwright Mutual Fire Insurance Company, Boston, gives some interesting experiences with concrete in fire. He prefaces his remarks with the following general statement:

The fact that a building is of concrete construction seems to carry with it the idea that it is fireproof, regardless of occupancy. This word fireproof is a misnomer when applied to any kind of a building and it is gradually being displaced by the word fire-resistive, which includes not only concrete construction, but also the type now so common involving steel frame work protected with tile, concrete or brick. No building is absolutely fire-resistive, for the resistance offered to fire is one of degree only, and if the heat be sufficiently intense and prolonged, nothing can resist it.

At high temperatures the surface of concrete is easily injured and spalls badly when water is thrown on it, and both actual fires and experiments have proved that where these temperatures run from 1,400 deg. to 1,900 deg. F., the surface of the concrete may be injured to a depth of ½ in. to ¾ in., or even 1 in, but the body of the concrete is not affected. Excellent heat insulation is afforded by concrete, but to obtain the best results a sufficient thickness must be applied, depending largely upon the occupancy of the building under consideration. Experience has shown that 2 in. of concrete will protect an I-beam with good assurance of safety. Obviously a building having combustible occupancy should have a heavier protection of concrete over reinforcing members than one having non-combustible occupancy.

The best fire-resistive materials are usually considered to be first-class Portland cement with quartz sand and broken trap rock. Limestone aggregate will not stand the heat so well as trap and the particles of gravel are more easily loosened by extreme heat. Cinders make a good aggregate for fire resistance, but the concrete made with them is not so strong as the rock concrete and cannot be used where high compressive values are necessary. Considered from an insurance point of view, cinder concrete is not so desirable as that made of trap rock on account of the porous quality of cinders; the insurance companies have learned that with cinder concrete they are called upon to pay losses on account of damage from water used at times of fire, which percolates through the small interstices of the cinders, which the cement mixture cannot reach, to the floors below.

The behavior of concrete in the great fires in Baltimore and San Francisco as reported in the various scientific publications at the time of these conflagrations is again offered by the writer, who sums up the general investigations in both fires to the effect that concrete stood well in both cases, even though the material used in San Francisco was of inferior grade and much of it flimsy material stiffened with light metal which had been passed as reinforced concrete. Coming down to a more recent period he says:

Reports from fires in other sections of the country furnish further interesting information. At the Dayton Motor Car Works, Dayton, O., and Huyler's building,

N. Y. C., the fires were so hot as to destroy all inflammable material and yet the buildings themselves were damaged to a very slight extent only; the burned-out floors were occupied within two days after each fire. Another example is that of a two-storey building of reinforced concrete construction used for drying purposes; this building was considerably exposed by frame buildings burned, one part of the concrete structure was subjected to severe heat from a burning boiler house and grease-extracting building. The heat melted the wire glass in the windows and burned up all combustible materials in the finish of the building, but the damage to the concrete walls and floors was very slight. Still another case is that of a reinforced concrete building, four storeys in height, in which the heat from a fire was so intense that it fused a piece of cast iron into a shapeless mass, but the only damage resulting was that in several places throughout the building the concrete was split off to a depth of ¼ in. to 1 in.

In the case of an extremely hot fire in a pulp and paper mill, the principal effect of the heat observed was to expand the floor and to cause a movement of the columns. On the morning after the fire, while the concrete was still hot, the end wall of the mill was noticeably out of plumb; later on, as the wall cooled, it drew back to the perpendicular. There were several minor breaks in the concrete and some parts of it were spalled off to a depth of about 2 ins. Where the concrete was rich in mortar there was less damage than where it was stony, the mortar acting as a protection to the aggregate. Where the fire was hottest the concrete was softened for an average of 1 in., so that it could easily be knocked off with an ordinary hammer.

Referring to the requirements of the Mutual fire insurance companies that sprinklers be installed in all manufacturing buildings having combustible material either in their construction or occupancy, he states that the use of these sprinklers has proven very effective. Instancing a case of this kind, he says:

Some interesting information was furnished in one of these fire-resistive buildings, which did not have sprinklers, by a fire that destroyed the contents. The building, which was occupied for general office purposes and had the usual fittings and trimmings of a modern office, was three storeys in height with 17-in. walls of brick and had tile and reinforced concrete posts and beams on all floors. On account of its superior construction and safe occupancy, sprinklers were thought not absolutely necessary. The intense heat generated by the burning of the hardwood overlay on the floors and the hardwood office fittings affected the brick walls, the concrete windowsills, and the concrete belt extending around the building at the third floor level. It is thought that most of the spalling of the concrete work was due to cold water from hose streams on the hot material. The structural strength of the concrete columns appeared to be very much reduced by the fire, and to determine whether or not it was necessary to replace them and the beams damaged in the fire, shores were placed under a third floor beam ½ in. clean at the top, to take the weight, should it settle when loaded. Careful measurements were taken of the distance between the underside of beam and top of floor below. A load of 16 tons of iron was placed on the third floor over the beams to be tested, and the deflection was 7/64 in. in the center of beam. This occurred at once when the load was applied, and did not increase when the test continued, namely, 3 hrs. For comparison, the same load was then placed over an uninjured beam elsewhere, and the same measurements taken, showing a deflection of 6/64 in., or practically the same as found in the damaged beam. No settling could be detected around any of the damaged posts when the load was applied.

In repairing this building a cement mixture was made and the beams and columns built out with it wherever spalling had taken place. It is doubtful that anyone examining the building to-day could detect any traces of this fire. It has been equipped with automatic sprinklers, and as a further precaution against another fire the new office furniture is all metal so far as could be obtained. From the writer's own experience, however, he would not consider this last precaution necessary, for in a building well protected with sprinklers the chance of a fire getting outside the area of two or three sprinklers is remote.

Cleaning Stone Work

A builder in Virginia had a contract involving the use of brick work with granite trimmings and he found it necessary to clean the stone work. He made the attempt with dilute acid, but it did not give satisfaction, although the stock brick around the trimmings cleaned up very nicely. The granite, however, still showed the streaks of dirt. He stated his case in a recent issue of The Painter's Magazine and the suggested remedy was as follows:

Builders' acid, which is equal parts of muriatic acid and water, will remove spots of mortar on brick or stone work, but is not the right material for cleaning stone that is begrimed from smoke and dirt. To accomplish this, apply to the surface, with a long-handled fiber brush, a strong solution of caustic soda or pearl ash. Let it remain on for about fifteen minutes, then wash several times with clear water, using a stiff brush or broom for the purpose. If this will not be effective enough, scrub the stone with a stiff fiber brush, using soft soap and concentrated lye and sand, allowing this to remain on the stone until nearly dry, then rinse with clear water, using a brush to remove the cleansing material. Protect your hands with rubber gloves.

A unique engineering problem is the construction of sufficient houses to quarter the men employed on the task of constructing the gigantic tunnel through the Selkirk range of the Rocky Mountains at Glacier, B.C. One of the problems the contractor had to face was the drifting snow in winter, which made it well nigh impossible to proceed with the work in a satisfactory manner, so they conceived the plan of building a village on stilts. The proposition was placed in the hands of a well-known architect and he was asked to draw up plans which, when finished, will cost $50,000. The floors of the houses, which will be of substantial construction, are to be eight feet above the ground. The streets will have no sidewalks, but will have a walk in the centre, also eight feet above the ground level and connected with the doors of the houses by little bridges.

It has been computed that there were used in the buildings erected in New York City last year 1,019,250,000 bricks, which is an increase of 93,187,000 bricks over the number needed for building operations in 1911. The cost of the brick used in last year's operations amounted to $5,858,770, as against $4,717,633, the cost of the pile used during the previous year.

Winter Fair Building, Regina, under construction.

Regina—A City in the Building

REGINA is rapidly becoming one of the live constructional centres of western Canada. Nearly every week one of our western correspondents sends us new information appertaining to building or engineering development and the list of stories apparently is far from being exhausted. Reproduced herewith are exterior and interior views of the new Winter Fair building, which is being erected for the city of Regina by the Parsons Construction and Engineering Company, Limited, at a cost of $133,000. The building has a steel frame with solid brick walls and its dimensions are 332 ft. by 191 ft. 6 ins. In the centre there is an oblong arena 220 ft. long and 85 ft. wide. The building has the regulation promenade and stalls for spectators. It is hoped to complete the structure by March 1st in time for the first Winter Fair and Horse Show which is taking place at Regina on March 6th.

The Canadian Bank of Commerce has recently erected an up-to-date bank building at Regina and the offices in this city have now been transferred to the new quarters. The building is elaborately finished throughout, marble, stone and ornamental plaster being used. Messrs. Clemesha & Portnal, architects, Regina, supervised the work.

The excavation for the new Sherwood $1,000,000 departmental store at Regina has been completed and a start made on the erection of the steel work. The contract for the steel work has been awarded to Charles D. Oliver, Canadian representative of the "M" System. It is claimed that the Sherwood store is the first building in Canada to be erected by this system. The girders and beams used in the building are composed of structural steel, and are so arranged that they take up all the tensile stresses, while the concrete which surrounds the steel members takes up the stresses of compression. The buildings erected on this plan differ from the usual run of buildings in that the steel is reinforced with concrete, rather than concrete reinforced with steel. It is proposed to use this new class of construction in the two buildings to be erected for the Hudson's Bay Company, one to be at Victoria, costing $800,000, and the other to be at Winnipeg, costing $3,500,000.

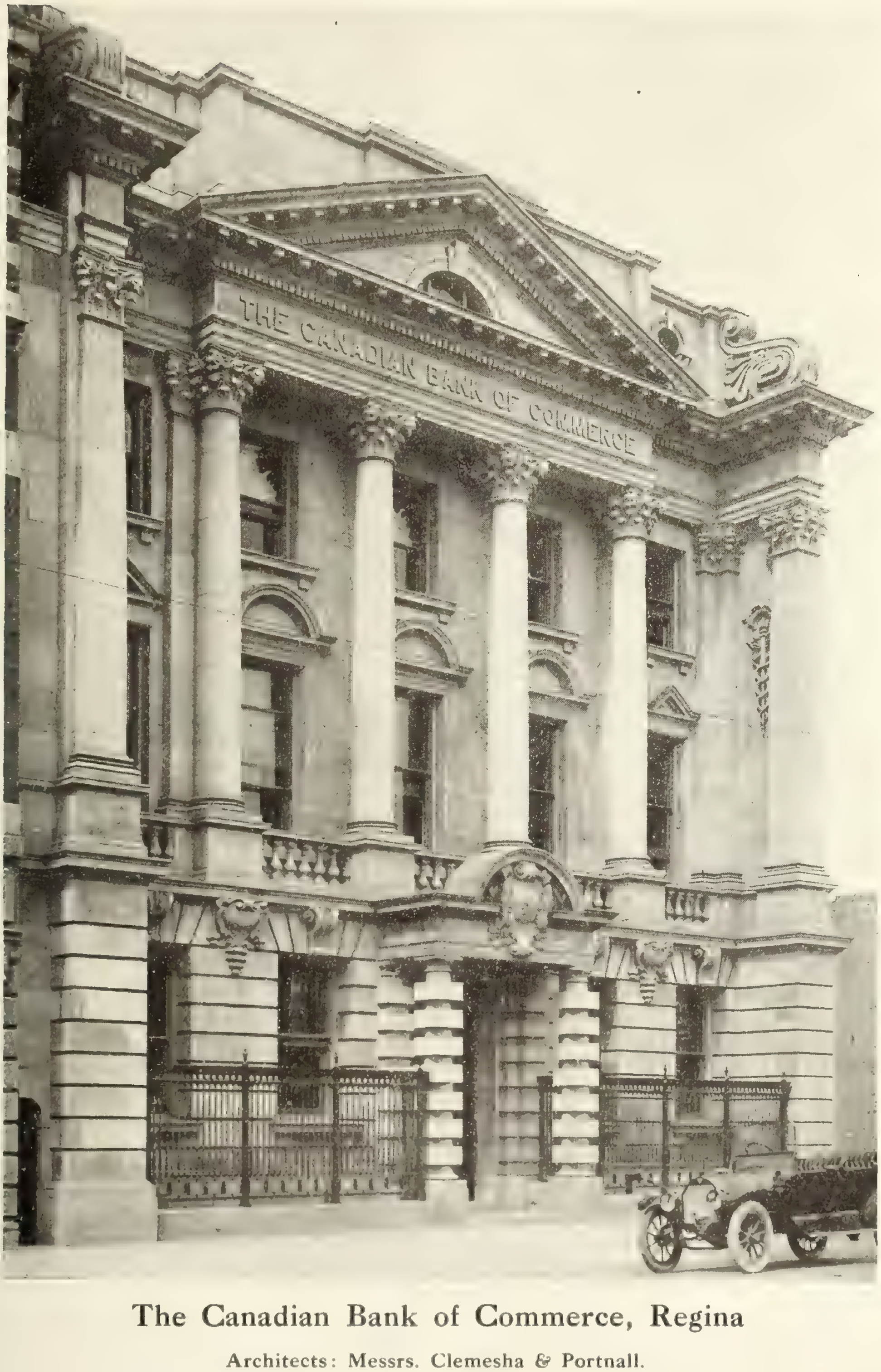
Regina's new building code, upon which Mr. R. O. Wynne-Roberts and the building inspector, Mr. A. Falls, have been engaged for some time, is in the final stages of preparation. Local constructional interests are awaiting its appearance with much interest, it being understood that it provides for a number of interesting departures in construction.

The Broad street subway, for which the Parsons Construction and Engineering Company were the contractors, is nearing completion. Twenty-three sets of track cross this subway and a double track of the street railway runs through it.

Arrangement of tellers' quarters and ledger desks.

Main entrance, vault and tellers' cage.

The Canadian Bank of Commerce, Regina.



The Canadian Bank of Commerce, Regina

Architects: Messrs. Clemesha & Portnall.

The Testing of Materials Used in Road Construction

By James G. Ross*

WITH the present era of good road building, increasing attention is being directed to the quality of the materials used in the construction of roads. To many people a rock is a rock, and any stone that happens to be convenient is used, regardless of its suitability. Too often its lack of wearing qualities is determined only by time, and a short time at that. Careful examination and testing of the material available will determine what is best suited to the conditions. The same remark applies to binders used, paving blocks, paving bricks, and various patented pavements.

A description of the methods employed in a commercial testing laboratory indicates that where roads are properly constructed, materials are selected only after careful testing. A thorough study having been made of the traffic conditions, the style of road best suited to give satisfactory wear at a reasonable price is decided on. If a rural district, a macadamized road will answer the purpose. An examination of the district is made to ascertain the available material. Should gravel be abundant, this should be inspected to see that it contains the requisite binding agent,—if in a rock district, the various points where rock can be quarried should be examined with a view to selecting the rock that will give the most satisfactory service. An examination by an engineer will disclose the most economical place for opening a quarry from which a uniform and satisfactory rock can be obtained. Should no rock be available in the vicinity, tests should be carefully made of the stone offered on the market to secure that best adapted to the conditions. Where field stone is used from old fences or farmers' stone piles, a few tests will show which rocks should be used for foundation and which reserved for top dressing. If, instead of a water-bound macadam road, one bound with oil, or bituminous substance is decided on, it is good economy to have these binding agents tested. Where brick or stone block is to be laid, the various makes of brick and block from different quarries are carefully tested and a decision arrived at as to which is the best to use. Cement is, of course, tested for all building purposes and should be tested for use in road foundations, gutters, culverts and bridges.

In France and Portugal, an elaborate system of testing various stones in service was carried out by digging up sections of the roadways and observing the wear on the stone, careful observations being also made of the traffic. These agreed so well with simultaneous laboratory tests that now all stone in these countries is selected as the result of laboratory tests. As early as the middle of the last century compression tests were made on rocks in the endeavor to determine their road building quality. The systematic testing of road materials may be said, however, to have begun during the decade opening with 1870, in France, where it has been developed steadily ever since. In recent years laboratories equipped with appliances for testing road materials have been installed by various State Geological Survey Departments in the United States and also at many colleges. The methods and results of tests of the Department of Public Roads at Washington, D.C., have been published in a series of reports which contain much valuable information. This has been used freely in the preparation of this article. No single material or class of materials will suit all conditions of climate and traffic. To get the best results it is necessary that the material selected, as well as the methods of construction, should be adapted to the special conditions of the road that is to be built or maintained. This is not always practicable and often impossible. Much can be done to determine which of the available materials is best suited for use.

An error in the selection of a material means an inferior road and occasionally complete failure. Such an error may cause a great loss of money to the community in which it occurs.

To obtain the best results on a macadam road, that rock should be selected which will resist the wear of the traffic to which it is subjected to such a degree as to supply just the sufficient amount of binding material to cement the road. Too much, or too little wear are alike injurious. When a road is first constructed a sufficient amount of binding material must be supplied to cause it to "come down" under the roller or traffic.

The values of a rock for road building purposes depends on its physical properties, per cent. of wear, toughness, hardness, specific gravity, and cementing value. These are determined by various tests.

Percentage of wear represents the amount of material under 0.16 Cm. in diameter lost by abrasion from a weighed quantity of rock fragments of definite size. This well-known test is similar in almost all respects to the Deval abrasion test of the French School of Roads and Bridges. It has been used since 1878, and is entirely satisfactory for the purpose for which it was designed. It is carried out in a machine called a Rattler and the specifications of the American Society for Testing Materials is as follows:

> "The machine shall consist of one or more hollow iron cylinders; closed at one end and furnished with a tightly fitting iron cover at the other; the cylinders to be 20 c.m. in diameter and 34 cm. in depth inside. These cylinders are to be mounted on a shaft at an angle of 30 degrees with the axis of rotation of the shaft.
>
> At least 30 lbs. of coarsely broken stone shall be available for a test. The rock to be tested shall be broken in pieces as nearly uniform as possible, and as nearly fifty pieces as possible shall constitute a test sample. The total weight of rock in a test shall be within 10 grams of 5 kilograms. All test pieces shall be washed and thoroughly dried before weighing. Ten thousand revolutions, at the rate of between 30 and 33 to the minute, shall constitute a test. Only the percentage of material worn off which will pass through a 0.16 cm. (1-16 in.) mesh sieve shall be considered in determining the amount of wear. This may be expressed either as the percentage of the 5 kilograms used in the test, or the French coefficient which is in more general use, may be given."

Toughness is here understood as the power possessed by a material to resist fracture under impact.

In testing macadam rocks under impact it has been found best to apply a number of blows of successively increasing energy and note the blow causing failure.

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* Engineer Milton Hersey Company, Limited, Montreal.

The following test involving this principle is, therefore, recommended by the A.S.T.M. for determining the toughness of rock for macadam road building:—

> "Test pieces may be either cylinders or cubes, 25 mm. in diameter, and 25 mm. in height cut perpendicular to the cleavage of the rock. Cylinders are recommended as they are cheaper and more easily made.
>
> The testing machine shall consist of an anvil of 50 kilograms weight, and placed on a concrete foundation. The hammer shall be of 2 kilograms weight, and dropped upon an intervening plunger of 1 kilogram weight, which rests on the test piece. The lower or bearing surface of this plunger shall be of spherical shape, having a radius of 1 cm. This plunger shall be made of hardened steel, and pressed firmly upon the test piece by suitable springs. The test piece shall be adjusted, so that the center of its upper surface is tangent to the spherical end of the plunger.
>
> The test shall consist of a 1 cm. fall of the hammer for the first blow, and an increased fall of 1 cm. for each succeeding blow until failure of the test piece occurs. The number of blows necessary to destroy the test piece is used to represent the toughness, or the centimeter grams of energy applied may be used."

With heterogeneous materials like most of the rocks used in road building, toughness depends on a number of factors,—among these may be mentioned interlocking of the crystals, the nature of the crystals themselves, and in some cases the nature of the cementing or binding agent.

Hardness is the resistance which a material offers to the displacement of its particles by friction, and varies inversely as the loss in weight by grinding with a standard abrasive agent. The test is made in the following manner:—the test piece in the form of a cylinder about 3 inches in length by 1 inch in diameter is prepared by an annular core drill and placed in the grinding machine in such a manner that the base of the cylinder rests on the upper surface of a circular grinding disk of cast iron, which is rotated in a horizontal plane by a crank movement. The specimen is weighted so as to exert a pressure of 250 lbs. per square centimeter against the disk, which is rotated in a horizontal plane by a crank movement. The specimen is weighted so as to exert a pressure of 250 lbs. per square centimeter against the disk, which is fed from a funnel with sand about 1½ m.m. in diameter. After 1,000 revolutions the loss in weight of the sample is determined and the coefficient of wear obtained by deducting one-third of this loss from 20.

The binding power, or as it has come to be called, the cementing value, of a road material is the property possessed by rock dust or other finely divided material found in nature to act as a cement on the coarser fragments composing crushed stone or gravel roads. This property varies enormously, not only with different kinds of rocks but also with those that are practically identical in classification and chemical composition. The absence of cementing power is so pronounced in some varieties of rock that they can never be made to compact with the road roller or under traffic. As the binder surface of a macadam or gravel road is most exposed to the action of wind and rain, as well as the wear and tear of traffic, it can be seen that the presence of this property is most essential to good results. Further than this, the hardness and toughness of the binder surface, more than the rock itself, constitutes the hardness and toughness of the road, for if a load be sufficient to destroy the bond of cementation of the upper surface of a road, the stones below are soon loosened and forced out of place. Moreover, it is a matter of common observation that a good surface which binds well is less dusty and less muddy.

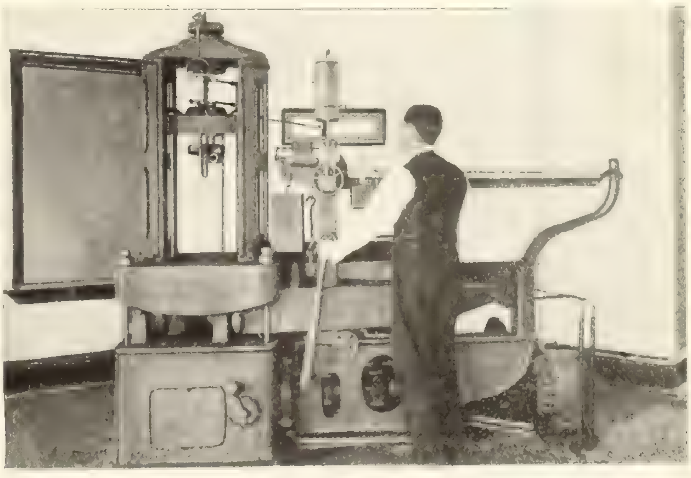
The specific gravity is the weight of the material compared with that of an equal volume of water, and is obtained by dividing the weight in air of a rock fragment by the difference of its weight in air and water. Given the specific gravity, the weight per cubic foot is found by multiplying this value by 62.5 pounds, the weight of a cubic foot of water.

Upon receipt of a rock sample, which should weigh not less than thirty pounds and be collected with care, according to specifications for sampling which may be had on application, to represent as nearly as possible an average of the whole exposure, it is examined in a general way to determine the proper method of analysis.

Rocks consisting essentially of the carbonates of lime and magnesia (limestones, dolomites, etc.) as well as fine-grained shales and unconsolidated sedimentary deposits, such as clays, sands, gravels, etc., are analyzed chemically when necessary, whereas all other materials are prepared for microscopic examination or determined microscopically.

The mineral composition of a rock, may, under favorable conditions, be estimated with considerable accuracy by a miscroscopic examination, yet for exact quantitative results the aid of a polarizing macroscope

Standard impact machine for road work.



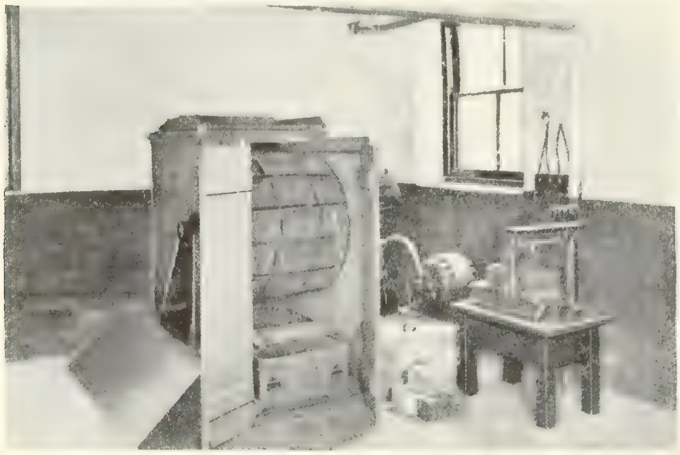
Autographic testing machine. Capacity 150,000 pounds.

and transparent thin sections of the rock are essential.

The macroscopic form of analysis can be applied only to coarse-grained rock, in which the various mineral components are easily detected with the unaided eye.

For microscopic examination thin transparent sections are made so that the various minerals comprising the rock may be identified. In connection with the work carried on in the chemical laboratory it has been frequently found of importance to determine the chemical composition of a rock from the volumetric proportions of its mineral constituents as determined by the microscope.

Rocks belonging to the same species, and having the same name, but coming from different localities, vary from each other in their physical road-building properties almost as much as they do from rocks of distinct species. Wide variation also occurs in the mineral composition of rocks of the same species, as well as in the size and arrangement of their crystals. It is impossible, therefore, to classify rocks for road building by simply giving their specific names. It can be said, however, that certain species of rocks possess in common some road building properties,—for instance, the trap rocks as a class stand heavy traffic well, as they are hard, tough, usually have binding power, and are therefore frequently spoken of as the best rocks for road building. This, however, is not always true, for examples have shown that some trap rocks having these properties in the highest degree, have failed to give good results on light traffic roads. The granite are generally brittle and many of them do not bind well but there are a great many which when used under proper conditions, make excellent roads. The felsites are usually very hard and brittle, and many have excellent binding power, some varieties being suitable for the heaviest macadam traffic. Limestones vary greatly but generally bind well; they are soft and frequently improve under traffic. Quartzites are almost always very hard, brittle, and have low binding power. The slates are usually soft, brittle, and lack binding power.



Standard rattler for abrasion tests of paving bricks.

There are, undoubtedly, practical road builders whose judgment on the road building quality of rock is excellent, but experience with materials of construction in general has proved that it is wise and economical to test the physical properties before entering on the expenditure of large sums of money.

There is another class of road materials whose toughness is due to a combination of properties not considered under the definition as applied to rocks. It includes those materials capable of considerable deformation without rupture when stressed beyond the elastic limit. Asphaltum and tar practically constitute this class. Bituminous compounds, bitumens, and dead oils distilled from tars under various trade names, are also used as binders.

The standard method for the determination of the loss on heating of oil and asphaltic compounds is specified by the A. S. T. M. as follows:—

> "The loss on heating of oil and asphaltic compounds shall be determined in the following manner:—twenty grams of the water-free material shall be placed in a circular tin box with vertical sides, measuring about 2 cm. in depth by 6 cm. in diameter, internal measurement. The penetration of the material to be examined shall, if possible, be determined at 25 deg. C., and the exact weight of the sample ascertained. The sample in the tin box shall then be placed in a hot-air oven (New York Testing Laboratory oven without fan) heated to 163 deg. C. (325 deg. F.) and kept at this temperature 5 hours. At no time shall the temperature of this oven vary more than 2 deg. C. from 163 deg. C. When the sample is cooled to normal temperature, it shall be weighed and the percentage of loss by volatilization reported. The penetration of the residue shall then, if possible, be determined at 25 deg. C., as upon the original material, and the loss in penetration found by subtracting this penetration from the penetration before heating. In preparing the residue for the penetration test it shall first be heated and thoroughly stirred while cooling."

The method for the determination of the penetration of bitumen as specified by the A. S. T. M. is as follows:—

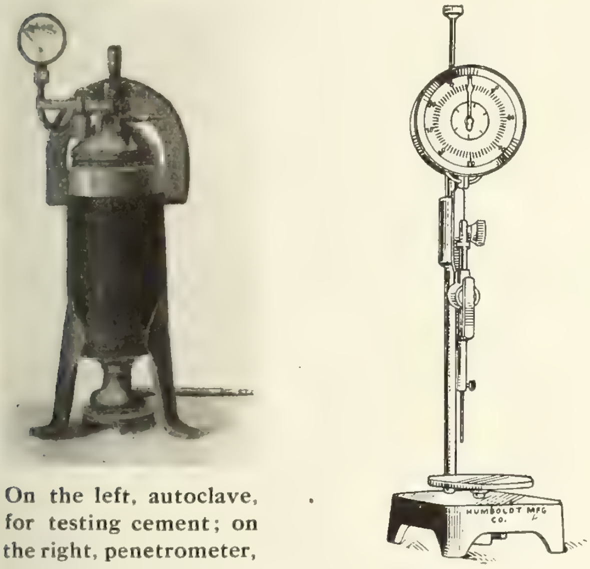
> "The penetration of bitumen shall be the distance expressed in hundredths of a centimeter that a No. 2 needle will penetrate into it vertically without friction at 25 deg. C. under a stated weight applied for a stated length of time, the factors of weight and time being determined as follows:—
>
> The material shall first be tested for five seconds under a weight of 100 grams. If this result is less than 10, the penetration shall be determined under a weight of 200 grams applied for one minute, if between 10 and 300, the penetration shall be determined under a weight of 100 grams applied for five seconds; if greater than 300, the penetration shall be determined under a weight of 50 grams applied for 5 seconds. In every case the factor of weight and time shall be stated when reporting the penetration, and whenever possible to obtain both readings, the penetration under a 100-gram weight for 5 seconds and under the modified weight and time shall both be reported. When testing material softer than 100 penetration, a containing receptacle not less than 1¼ inches in diameter shall be used.
>
> It is recommended that the penetration may be determined at 0 deg. C. (32 deg. F.) and 46 deg. C. (114 deg. F.) in addition to the 25 deg. C. (77 deg. F.) test."

When paving blocks or paving brick are submitted, they are tested for absorption, tensile strength, hardness, toughness and specific gravity.

The blocks are examined macroscopically, for a block made of gneiss or foliated granite would develop planes of weakness. Hardness, toughness and specific gravity are determined, as in the case of rock for macadam road, except that in the test for hardness the Rattler is loaded with cast iron blocks or shot.

> "The machine for conducting this test consists essentially of a rotation drum partially filled with large

and small cast iron blocks or shot. The wearing quality of paving brick is judged by the loss sustained after a sample has been subjected in this drum for one hour to the impact and abrasion of these cast iron shot. For the first 600 rotations the loss is mainly due to a chipping action which develops the brittleness of the brick; between 1200 and 1800 rotations the loss is mainly due to an abrasive action which develops the softness of the brick. During the test any defects of structure, such as planes of separation, will probably result in rupture. The Rattler is 28 inches in diameter and 20 inches long and has 14 steel slats. It is run at a speed of 30 rotations per minute for 1800 revolutions. The charge to be placed in the rattler consists of nine paving blocks or twelve dry bricks, together with 300 pounds of shot made of ordinary machine cast iron. The shot are of two sizes. The larger (2½ by 4½) weigh 7.5 pounds each and have slightly rounded edges; the smaller shot (1.5 inch cubes) weigh about seven-eighths of a pound each. The charge is composed of 75 lbs. of the larger and 225 pounds of the smaller size. The individual shot are replaced by new ones when they have lost about one-tenth of their original weight. The loss in weight undergone by a sample of brick under test at the end of 1800 revolutions is found by comparing the original weight of the brick with its weight after test. The loss in per cent. of the original weight is the factor determining the quality of the brick. For the best paving brick this loss should not be in excess of 18 per cent. The above conditions are those demanded in the standard specifications recommended by the National Brick Manufacturer's Association."



On the left, autoclave, for testing cement; on the right, penetrometer, for determining the consistence of asphalt.

Paving brick and paving blocks are sometimes tested for compressive strength. This is done in a testing machine which has two screws so that tests may be made for both compressive and tensile strength. The bricks are tested either in the same position as in service or on the flat, being bedded in sheets of lead or plaster of paris. The maximum compression of this machine is 200,000 pounds per square inch.

Cement is tested according to the methods of the A. S. T. M. and should conform to the following specifications:—

Specific Gravity.—The specific gravity of cement shall not be less than 3.10. Should the test of cement as received, fall below this requirement, a second test may be made upon a sample ignited at a low red heat. The loss in weight of the ignited cement shall not exceed four per cent.

Fineness.—It shall leave by weight a residue of not more than 8 per cent. on the No. 100 and not more than 25 per cent. on the No. 200 sieve.

Time of Setting.—It shall not develop initial set in less than thirty minutes; and must develop hard set in not less than one hour, nor more than ten hours.

Tensile Strength.—The minimum requirements for tensile strength for briquettes one square inch in cross section shall be as follows, and the cement shall show no retrogression in strength within the periods specified:—

NEAT CEMENT

Age	Strength
7 days (1 day in moist air, 6 days in water)	500 lbs.
24 hours in moist air	175 lbs.
28 days (1 day in moist air, 27 days in water)	600 lbs.

ONE PART CEMENT, THREE PARTS STANDARD OTTAWA SAND

Age	Strength
7 days (1 day in moist air, 6 days in water)	200 lbs.
28 days (1 day in moist air, 27 days in water)	275 lbs.

Constancy of Volume.—Pats of neat cement about three inches in diameter, one-half inch thick at the centre, and tapering to a thin edge, shall be kept in moist air for a period of twenty-four hours.

(a) A pat is then kept in air at normal temperature and observed at intervals for at least 28 days.

(b) Another pat is kept in water maintained as near 70 deg. Fahrenheit as practicable, and observed at intervals for at least 28 days.

(c) A third pat is exposed in any convenient way in an atmosphere of steam, above boiling water, in a loosely closed vessel for 5 hours.

These pats, to satisfactorily pass the requirements, shall remain firm and hard, and show no signs of destortion, checking, cracking, or disintegrating.

A more rapid determination is made by the autoclave, which detects unsoundness that might not be shown by the above test.

Sulphuric Acid and Magnesia.—The cement shall not contain more than 1.75 per cent. of anhydrous sulphuric acid (SO_2), nor more than 4 per cent. of magnesia (MgO).

Wood block, creosoted wood, tile piping for drains, and reinforcing iron for bridge floors are also tested.

THE APPLICATION OF LABORATORY RESULTS TO PRACTICE

The proper interpretation and application of the results obtained in the laboratory are quite as important as the general accuracy and appropriateness of the tests themselves. It is probable that many engineers and others interested in the subject of road building who have found time to examine the question only superficially have not understood the bearing and value of road material testing. In all cases the results obtained in testing materials of construction are of relative rather than absolute value. Even a large variation in the results yielded by different test pieces of the same sample should not condemn the practical value of the figures if they are properly applied and interpreted. The necessary qualities of road material have to be considered from the double standpoint of furnishing a strong unyielding, well-drained road foundation and a hard coherent binder surface. In road building the attempt should be made to get a perfectly smooth surface, neither too hard, too slippery, nor too noisy, and as free as possible from mud and dust, these results to be attained and maintained as cheaply as possible. Such results, however, can be achieved only by selecting the material and methods of construction best suited to the conditions.

Given a number of materials for laboratory examination, it is not pretended that an actual grade of excellence can be established. On the other hand, if more than one material is available, it is quite possible for the laboratory to point out which one would yield the best results, both as to immediate excellence and length of life under known conditions of climate and traffic. Undoubtedly in many cases, large sums of money have been wasted in building roads from unsuitable material, which might have been saved by referring the materials to the laboratory.

A road material cannot be selected, irrespective of the volume and character of traffic and the climatic conditions to which it is to be subjected, without the risk of failure. When the very great cost of even rural highways is considered, it is evident that it is gross negligence not to use every preliminary precaution to guard against expensive mistakes.

Design of Steel Mill Buildings—Part I.[*]

Review and Discussion of Practical Considerations Governing Their General Features, Proportioning and Detailing

By R. J. Fleming [†]

THE purpose of this article is to call attention to some practical points that enter into the design of steel mill buildings. Articles written from the professor's chair are sometimes purely academic. The assumptions made, and upon which conclusions are based, are often found in actual practice to be incorrect. A thorough knowledge of the theoretical treatment of the various phases of mill building design given in the text books is necessary but will not in itself confer the ability to design a mill building that is economical or adapted to practical needs. This knowledge should be supplemented by one's individual experience as well as by the experience of others.

The engineer having a building to design will usually consider the different features of his work in the order followed below.

At the very outset he should possess himself of all available data. For what use is the building intended, and what are the probable uses to which it may be put? Upon these two questions largely depend the loads to be assumed for floors, the kind of covering for the roof, the amount of light, heat and ventilation required. The geographical location will decide the snow load. Sometimes the proposed building is within the limits of a city having a building code. A copy of this should be procured. Incidentally, a design based on sound engineering principles should be affected only in minor details by a building code, provided the code represents sound engineering principles. Local conditions may govern the selection of material to be furnished. As a matter of course, attention must be given to the preference of the owner.

If the building is to be used for manufacturing purposes, a lay-out of the machinery should be obtained from the mechanical engineer. This is necessary to locate interior columns to the best advantage. In these days of specialization we have also the heating and ventilating engineer, the illuminating engineer, the sanitary engineer, and others, engaged on the structure. The order of precedence may be as follows: Mechanical engineer, structural engineer, architect, other engineers.

When the steelwork is but a comparatively unimportant part of the structure the work of the architect precedes that of the structural engineer. When the steelwork predominates, the structural engineer should take the lead, while in the design of many mill buildings he is both engineer and architect.

It is seldom the good fortune of the engineer to be called upon to design an industrial plant from the start on a new site. Generally the proposed building is an addition to another building or a building added to a group of buildings. Most large manufacturing establishments are a growth from humble beginnings. Buildings are enlarged or new ones built to meet the exigencies of the time without much thought of future requirements. This growth will in most cases continue, and in designing new buildings provision should be made for their future extension. The conditions of the present work should be thoroughly understood.

In many cases data to the extent outlined can not be obtained. In work for export the inquiry is often very crude, little more than the uses to which the building is to be put and the approximate dimensions being given. Recourse must then be had to plants previously built for the same kind of work. A knowledge of buildings similar to those which the engineer is called upon to design is always valuable. The files of the technical papers for the past 10 to 20 years are rich in plans and descriptions which can be studied with profit.

Lighting

The demand of the industrial world to-day is for greater efficiency. To meet this demand in mill buildings attention should be given both to the machine and to the man. Better means of handling material will increase the output and lessen cost. Given a more favorable environment in the way of light, heat, and ventilation, the workman is more efficient, resulting in a larger and better output. In late years the question of proper lighting and its economic value has been widely discussed.

The United States Census of 1910 gives for the year 1909 the number of manufacturing establishments as 268,000, engaging 7,678,000 persons, of whom 6,615,000 were wage earners. The value of the products during the year was over twenty billion dollars, of which the portion added by manufacture (value of products less cost of materials) was over eight billion dollars. Assuming that the value of the output could be increased 1½ per cent., a low estimate, if better illuminating methods were used, we have an annual saving for all industries of $315,000,000.

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[*] Courtesy of the Engineering Record.

[†] Designing Engineer, American Bridge Company, New York City.

Out of an average 24-hour day we have 11¾ hours of darkness, 4½ hours of cloudy or foggy atmosphere and only 7¾ hours of sunshine. Hence manufacturing plants must operate for part of the time by artificial light. We now have the illuminating engineer to deal with this feature.

The structural engineer, however, should, if it is possible, design his building to admit all the natural light needed during the day. This is generally done by using windows in the sides and, for the portion of the building the windows fail to light, skylights in the roof. The windows should be low, if there are benches along the wall or if light is needed near the sides, and they must be high to light the central portion of the room. A good plan is to have them begin 3 ft. from the floor and extend as high as possible. When balanced sash can be used, the expense of counterweights is saved.

A monitor, the purpose of which is to light or ventilate the building, is often built on the ridge of the roof, running from end to end, or stopping one panel from each end, with swing or sliding sash in the sides. The sash give ventilation as well as light. For the best results the monitor should have a width about one-fourth that of the roof on which it rests. Skylights in the roof are expensive, are liable to breakage, are a frequent cause of leaks, and when covered with snow do not admit light. Their use should be restricted to a minimum.

The proper proportion of glass surface to the side and roof areas of a building varies widely according to its uses. Fowler's "Specifications for Steel Roofs and Buildings" says as to this point:

"Windows shall be provided in the sides and clerestory or ventilator of a surface equal to not less than 10 per cent. of the entire exterior surface of the building, in mill buildings, and of not less than 20 per cent. in machine shops or similar buildings.

"At least half of the lighting specified shall preferably be in the form of skylights, of some form of construction, which shall entirely prohibit leaking."

This proportion is small for the sides and large for the roof. The East Side Machine Shop at Pencoyd, which is an unusually well lighted building, has one-eighth of the roof surface and one-half of the side and end surfaces covered with glass. Steel frame buildings having narrow concrete pilasters around the columns, and belt courses, also of concrete, at the floor and eave levels, with the balance of the sides filled with steel sash, are illustrated in the catalogues of the leading manufacturers of steel sash. With this construction almost the entire sides and ends are of glass. It might be noted here that the greater the expanse of glass the greater is the cost of heating and danger of breakage.

For large areas covered by one-storey buildings, where a great amount of light is needed, what is known as "saw-tooth" roof construction has come into great favor. It is a series of trusses with one side vertical or slightly inclined and glazed, and the other side covered with roofing. Ketchum in his "Steel Mill Buildings" devotes a dozen pages to this style of roof construction. It should not seem necessary to admonish the designer that the glazed portion of such roof should face the north.

The question of heating is not within the province of this article. Suffice it to say that there are many systems of heating—a common one being the forcing of fresh air over heated pipes in a cast iron case and from thence distributed through conductors into various parts of the building. This system has the advantage of combing ventilation with heating.

Ventilation

The design of the building should provide for proper ventilation. The ventilating area required varies from ½ to 8 sq. ft. for every 100 sq. ft. of floor area, according to the uses of the building. When ventilation is the prime factor, little or no light being required, swinging shutters or fixed louvres, generally made of sheet metal, are used in the sides of the monitor in place of sash. Continuous rows of sash or shutters are sometimes placed in the sides of buildings, but more commonly ventilation from the sides is secured by the windows.

The steel sash people make their sash so that certain portions can swing on pivots. An operating device will enable the whole system of pivoted sash, whether in the sides of the monitor or in the sides of the building, to be easily controlled from the floor. A number of makes of tubular ventilators of galvanized steel are on the market. They give excellent service and can be placed on the roof where needed—the ridge being naturally the appropriate place. Ventilation is also secured artificially by forcing air through conductors by means of fans and blowers.

Important points to be considered in the choice of a roof covering are the uses to which the building is to be put, the roof pitch, the possibility of fire, the climatic conditions, the presence of gases, the appearance of the finished building, permanence and cost. The list of roof coverings is a long one; sheet metal, slate, tar and gravel on plank, tile, hyrib, tin, together with composition roofing of many kinds, are all familiar forms. Each has advantages for certain conditions.

Corrugated steel, either painted or galvanized, is a cheap covering and can easily be renewed when necessary. It is much used for sheds, car barns, rolling mills, and similar structures. It is laid on channel or angle purlins spaced to fit the sheets. The sheets most in use are 7, 8 and 9 ft. long. When laid each sheet should be supported at the centre as well as at the ends by a purlin. The standard laps are 6 in. for the ends of sheets and one and one-half corrugations for the sides. The best pitch for a corrugated steel roof is 6 in. to the foot. Five inches to the foot will answer, but when less than 4 in. the roof is liable to leak during a shower accompanied by a high wind, the water being pushed up between the end laps of the covering. A greater lap than 6 in. will partly remedy this trouble but will not do away with it altogether.

Preventing Condensation

When the temperature of the room inside is considerably higher than that of the air outside, condensation will take place on the under side of the corrugated steel and drip on the floor below. In such cases other covering should be used or sheathing placed under the corrugated steel. An "anti-condensation" lining under the sheets is sometimes used; it is made of one or two layers of asbestos paper and one or two layers of tar paper, resting upon galvanized wire netting attached to one eave purlin and stretched over the ridge to the other eave purlin.

In buildings for export to warm climate there is a feeling against the use of corrugated steel. In a tropical climate its deterioration is rapid. This may be retarded by galvanizing but can not be prevented entirely. It is much the same when subject to the action of certain gases. For this reason corrugated iron may be called for, although it is more expensive and often difficult to procure. In a copper refining plant near Bayonne, N.J., the corrugated steel roof and sides of a building had to be renewed 18 months after it was finished. Another building near by, erected at the same time and subject to the same uses, with roof and siding of corrugated iron, is still doing good service after eight years of use.

Slate laid on plank is a favorite covering. Its first cost is high, but it is lasting, is not affected by gases, and seldom needs repairs. A normal pitch is 7 in. to the foot, though 6 in. is frequently used. For low pitches—4 in. or less to the foot—the same trouble with leaks as with corrugated steel will be experienced, but it will be intensified by the greater number of laps. Slaters' cement for the laps is a salve, not a cure.

Tar and gravel on plank sheathing have been used for many years when the pitch is from ½ to 2 in. to the foot. For a greater pitch than this the covering will wash off during a hard rain with the result that the roof will leak.

The fire-resisting qualities of reinforced concrete are causing it to come more and more into favor. It can be used for any pitch and adapted to any waterproof covering.

It is highly important that the choice of covering be adapted to the pitch of the roof or vice versa. The lack of this adaptation is a prolific cause of leaky roofs, and a leaky roof not only entails expense for repairs but, what is sometimes more serious, damage to stock or machinery.

Sides

The siding for mill buildings varies, though not through as wide a range as the roofing. If corrugated steel is used for the roof, the sides are often made of the same material, though of lighter weight. If No. 20 gage is used for the roof, No. 22 can be used for the sides. Less than No. 22 should not be used for roofs nor less than No. 24 for siding.

To the common construction of brick walls between steel columns but little objection can be raised. There should be steel lintels over window and door openings unless the openings are narrow, when brick arches will answer. If the sides are thin curtain walls, the lintels should extend from column to column and be designed to carry the wall above. They thus act as struts between the columns as well as beams. In the buildings of the Ambridge plant of the American Bridge Company, the side walls throughout are of concrete 8 to 12 in. thick. The walls are carried by the steel columns.

No one kind of floor is adapted for universal use. For rolling mills, forge shops or foundries, which have only a ground floor, earth well tamped will generally answer. Sometimes the ground floor is made of brick or cement. For the floors of machine shops, mills and factories a common practice is to use yellow pine planks with a wearing surface of 1 in. hard maple. Buckle plates covered with concrete with a cement finish, steel trough floors, corrugated steel arches and concrete, checkered steel plates, reinforced concrete, and a number of patented floors are all in more or less use, though mostly for upper floors.

Roof Loads

The loads for which the steel portion of a roof is ordinarily designed are the weight of the structure itself, called the dead load, the snow load and the wind load. The dead load includes the weight of the steel truss, the purlins, roof covering, bracing, and any other loads which are permanently a part of the roof. This load varies from 5 or 6 lb. per square foot for the lightest kind of corrugated steel roofs to 30 or 40 lb. per square foot for concrete roofs. The snow load varies according to locality. Fresh fallen snow weighs from 5 to 12 lb. per cubic foot. A load of 20 lb. per square foot is ample provision for snow load on roofs in the latitude of New York.

The wind load may be assumed equivalent to a pressure of 20 lb. per square foot. It is good practice, though not universally adopted, to assume for roof trusses a combined dead, snow, and wind load per square foot of exposed surface, applied vertically. Schneider's "General Specifications for Structural Work of Buildings" follows this method and recommends that for ordinary roofs up to 80-ft. span, in climates corresponding to that of New York, the following loads per square foot be used:

	Lb.
Gravel or composition roofing on boards, flat slope, 1 to 6, or less	50
Gravel or composition roofing on boards, steep slope, more than 1 to 6	45
Gravel or composition roofing on 3-in. flat tile or cinder concrete	60
Corrugated sheeting on boards or purlins	40
Slate on boards or purlins	50
Slate on 3-in. flat tile or cinder concrete	65
Tile on steel purlins	55
Glass	45

In tropical climates, where there is no snow, the above loads may be reduced 10 lb. In some parts of New England and the Northwest where there are unusually heavy snows the loads should be increased. The reader acquainted with the text books and taught that the wind acts normal to the roof surface and that the stresses in members differ according to their location on the windward or leeward side will at once question the right to consider the wind acting vertically along with the dead and snow loads. The answer is that the error, if there be any, is negligible.

It is needless to make a separate calculation for each kind of load and each case of wind loading. The reader can easily prove this for himself. Assume a wall-bearing roof truss of the Fink type, say of 60-ft. span, a pitch of 6 in. to the foot, and trusses 16 ft. apart. Of the 40-lb. per square foot load, let 20 lb. be the wind load and 20 lb. the dead and snow load. Using the graphical method proceed as follows:

Graphical Method

(1) Make a stress diagram for the 20-lb. dead and snow load, the loads being concentrated at panel points of the top chord and acting vertically;

(2) Make a stress diagram for a wind pressure of 20 lb. on one side and normal to the surface, the loads being concentrated at the top chord panel points of one side and the truss considered to have both ends fixed;

(3) Make a stress diagram for the same wind pressure, considering the end on the truss on the windward side to be fixed and the end of the leeward side to be free or on rollers;

(4) Make a stress diagram for the same wind pressure, considering the windward side of the truss to have a roller end and the leeward side a fixed end;

(5) Show on a diagram of the truss the stresses due to a vertical load of 40 lb. per square foot of ex-

posed surface. These stresses are double those found in (1).

By a comparison of the algebraic sum of stresses found under (1) and either (2), (3) or (4) with (5) it will readily be seen that the differences do not affect the size of a single member.

Shafting is sometimes carried by the lower chords of the roof trusses. This causes stresses indeterminate in amount, but if the shafting is light a stiff lower chord made of two channels or plates and angles will provide for it. If the shafting is heavy the whole truss should be strengthened by adding 10 lb. per square foot to the assumed roof load and using a stiff lower chord. Sometimes a given load is to be lifted from any point of the lower chord, or it is to carry a monorail or light crane. These loads are all definite in amount and stresses due to them can be easily calculated.

Floor Loads

The dead load of the floor, consisting of the weight of the steel supports and the materials composing the floor proper, varies between wide limits—from 20 lb. per square foot to 80 lb. and more, according to the floor construction. The live load which should be used varies, according to the uses of the room, from 60 lb. per square foot for the floors of pattern and template shops to 600 or even 1,000 lb. per square foot for the charging floors of cupola rooms. Machine shop floors, owing to vibration of machines and the liability of concentrated loads, should be calculated to carry from 150 lb. per square foot when the machinery is light to 300 lb. per square foot when it is heavy.

For floors of factory buildings, with machines as close together as they can be placed, the live load should seldom be assumed less than 200 lb. per square foot. For heavy work it may be more. The weights of particularly heavy machines should be determined, and ample provision made for carrying them. Note should be made if stock or materials are to be heaped upon the floor in any considerable quantity. In speaking of floor loads the non-technical man generally means the live load and not the combined live and dead. There should be no misunderstanding with the owner on this point.

Crane and Special Loads

The travelling crane is an important feature of the modern mill building. Hand power cranes are occosionally used, but the vast majority of travelling cranes are electrically driven. Travelling cranes vary in their lifting capacity from 3 to 5 tons, used in light machine shops, to 150 and 175 tons, used in locomotive shops and steel-furnace buildings. Probably more cranes of 10-ton than of any other capacity are used. Up to about 60 tons capacity they are generally carried on a two-wheel truck at each end with a wheel base of 8 to 12 feet.

Cranes of 60 to 120 tons capacity should be carried on a four-wheel truck at each end, while the trucks for 150-ton cranes should have eight wheels. It is difficult to procure rails or design girders that will properly withstand the great concentrated loads that come from too few wheels. For this reason preference should be given to the crane having the greater number of wheels under the trucks. The maximum loads that can come upon the wheels should be obtained from the crane maker. If the make of crane has not been decided upon, the loads given in published tables may be used. The wheel bases and maximum wheel loads of standard cranes, with the exception of those of one maker, vary but little. It is the custom to add 25 per cent. to the maximum wheel loads for impact, as the crane is a moving load and is liable to be started quickly or brought to a sudden stop.

In addition to the vertical loads the girders or runway of a travelling crane should be designed for lateral stiffness. The neglect of this has been the cause of failure of more than one crane runway. The lateral load may be assumed to be 20 per cent. of the transverse moving load—one-half at each end of the crane divided equally between the truck wheels. This assumes that double flange wheels are used on one side. The owner may request that a crane runway be designed to carry a heavy load for a given distance from one end and a lighter load for the remaining portion. A design of this kind should not be drawn, or, either through ignorance or intention, the heavy load will sometimes be brought on the portion designed for the light load. The blame for any disaster invariably falls upon the designer.

Jib cranes are attached to roof trusses, to floor beams, and to columns. The horizontal force in any position of the boom should be analyzed. In a power plant the question of coal storage should be taken into consideration and bunkers or bins designed where required. Heavy economizers may be carried on the floor of the boiler room, and dynamos on the floor of the engine room. Many buildings carry special loads peculiar to the trade for which they are built—in cement mills are storage bins and in smelting plants are ore bins. The character of loading should be obtained.

Unit Stresses

With the external loads given, the internal stresses in the supporting members of a structure can generally be determined. Some members have direct stresses, others bending stresses, and others a combination of both. In proportioning members the following may be assumed as unit or working stresses in pounds per square inch for open hearth medium steel generally used for mill buildings:

Tension, net section	16,000
Bending on extreme fibers of rolled shapes and riveted girders	16,000
Shear on plate girder webs (net section)	10,000
Shear on rivets (shop)	12,000
Shear on rivets (field) and bolts	10,000
Bearing pressure on rivets (shop)	24,000
Bearing pressure on rivets (field) and bolts	20,000

(To be concluded)

Mr. Chas. S. Cobb has been awarded first prize in the competition for the design for the new registry office building at Toronto. Mr. Cobb will receive $1,000 as winner of the first prize and the terms of the competition provide for his inspection of the erection of the building. Second and third prizes of $600 and $400 respectively go to Messrs. Chapman & McGiffin and Messrs. Symonds & Rae. The assessors were Messrs. A. R. Denison, C. H. C. Wright and R. H. Bowes.

Over two million concrete blocks have been used so far in the new $10,000,000 plant of the Minnesota Steel Company, at New Duluth, Minn. The company is now about to start the construction of two hundred concrete block houses and sixty-five apartment buildings, each to accommodate six families. The plans, which have been prepared by Dean & Dean, architects, Chicago, call for block walls and monolithic floors.

Railroad Practice in the Construction of Sewers and Drains

Committee Report, American Railway and Bridge Association

At the twenty-third annual convention of the American Railway and Bridge Association, held in Montreal last month and reported in our issue of October 29th, a number of valuable reports were presented by the various committees. Perhaps the most interesting of these, from the viewpoint of many readers of this journal, was that relating to sewers and drains. This contained much excellent information likely to be of value in practice. Following is the report:—

Report of Committee

Sewers, as referred to in this subject, are intended to carry the excremated matter from railroad buildings to the main sewer, stream or cess-pool. The necessity for prompt and complete removal of sewage from the building and its disposal in a way the least offensive and injurious to health is a matter well worth consideration.

Drains are used in connection with railroads for carrying off surplus water from buildings and pits, and are simpler in construction than sewers. Ordinarily they do not require tight joints and traps, and they are often built of wood or common drain tile; but the larger sizes are usually built of sewer tile.

In order to enable the committee to submit a report on this subject, letters of inquiry were sent to several officials of the various railroads throughout the country and answers were received to about twenty per cent. of the letters, which indicates quite a bit of interest on the part of our members to assist in our work, for which we take this opportunity to thank all contributors.

After careful consideration as to the practice, experience and opinions of our contributors, we offer the following as a progress report, hoping that the few points touched upon in this paper will bring forth sufficient written matter and oral discussion to make the subject worthy of publication in our proceedings.

Material.—For sewers cast iron pipe or vitrified sewer tile is recommended, as the conditions may require. Cast iron soil pipe should be of standard weight free from flaws, cracks, air bubbles or other imperfections, and it should be tested to 50 lbs. water pressure previous to tarring.

Vitrified sewer tile should be of standard thickness, good quality, salt glazed and well burnt throughout its thickness; impervious to moisture, smooth and well glazed on exterior and interior surfaces, free from cracks, flaws, blisters, fire checks and other imperfections.

For drains, cast iron soil pipe or common sewer tile may be used, according to the local conditions.

General Considerations.—Sewers and drains should be carefully studied, surveyed and mapped out, both for greater accuracy of work and for location of the line afterwards. Particular stress is laid upon the importance of the grades, to avoid dips or depressions in the line which might work mischief with the system.

The area of the trunk or main sewer should be equal to the area of all intermediate connections, allowing for difference in velocity of flow. The following table will give the approximate carrying capacity of different sizes of drain pipe, in U. S. gallons per minute, for grades varying from one inch to 36 inches fall in 100 ft.

Fall per 100 ft. Inches		Diameter of pipe in inches								
		3	4	6	9	10	12	15	18	24
1	Gals.	13	27	75	205	267	422	740	1.168	2,396
2	"	19	38	105	290	378	596	1,021	1,651	3,387
3	"	23	47	129	355	463	730	1,282	2,022	4,152
6	"	32	66	183	503	655	1,033	1,818	2,860	5,871
9	"	40	81	224	617	803	1,273	2,224	3,508	7,202
12	"	46	93	258	711	926	1,468	2.464	4,045	8,303
24	"	64	131	364	1,006	1,310	2,076	3,617	5,704	11,744
36	"	79	163	450	1,240	1,543	2,554	4,467	7,047	14,466

Angles in sewers and drains should never be used where it is practicable to do without them. Under ordinary conditions, where it is absolutely necessary to make an angle in a pipe line, long radius bends should be used, on account of less interruption to the flow. Where it is necessary to provide cleanout basins in a pipe line they may be made to act as the turn. Where the angle is greater than 45 degrees, brick or concrete turns, with a cleanout basin, should be used.

Where necessary, traps should be placed in the pipe line and a hand hold should be provided in the pipe line near each trap, so that the trap can be cleaned or raked. The trap alone offers some resistance to the flow, and where a hand hole is made in the trap it adds another probability of obstruction.

Drains should be provided with a screen or grating at the inlet to keep sticks and rubbish from entering. Where dirt, sand, boiler washings and other sediments are liable to enter, a large catch basin should be constructed as near as possible to the inlet end. In this materials may settle and may be removed, from time to time. If the water carries a fine silt and the drain is of considerable length, other smaller catch basins should be placed in the line, for the same purpose as the larger one. The large basin should have a depth of at least three feet and the smaller ones two feet, below the line of the drain.

When a pipe line is laid in soft earth or in a marsh, it is often necessary to provide a foundation to keep the pipe from settling. We find various methods used, namely: the use of piling, cinders, a concrete base, timbers cross laid, wooden trestles, wooden cradles, and concrete cradles, all of which can be used advantageously. Matters of this kind are decided largely with respect to the material locally obtainable.

Where a drain or sewer is laid by contract, frequent inspection of the work should be made during construction to see that specifications are being carried out, and, where necessary, a regular inspector should be assigned to the work. It is a very difficult and expensive matter to locate a defect in a pipe line after it has been laid and covered.

Where water pressure is obtainable pipe lines may be given a pressure test after laying and before they are covered up. A pipe line may also be tested with air or smoke.

Laying.—Where sewer pipe is laid under buildings or under granatoid or cement sidewalks or platforms, or under tracks, it should be of cast iron; otherwise it might be of best quality, salt-glazed, vitreous terra cotta. All cast iron pipes should be neatly and snugly fitted together, the joints being well caulked with picked oakum and molten soft pig lead, using 12 oz. of lead for each inch of diameter of pipe in which joints are made. No cement or putty joints should be permitted, and wherever connections are made they must be laid with "Y" branches, long curves and one-eighth bends.

Vitrified sewer tile should be laid with joints closely fitted together in such manner that there will be no shoulder or lack of uniformity of surface on the interior of the drain. Each joint should be wiped clean of mortar on the inside before another joint of pipe is laid. The joints should be well cemented together with a mixture of one part Portland tested cement and two parts of clean sharp sand. The cement should be pressed into the space between the socket and spigot so as to fill it completely. After cementing the joints together care must be taken not to disturb the pipe.

In laying common sewer tile for drains we recommend cementing the joints the same as in laying sewer pipe.

APPENDIX

We submit herewith a copy of the circular letter of inquiry sent out, together with extracts from some of the replies received, omitting such matter from some of the replies received as would repeat data or information contained in others.

Circular Letter of Inquiry

1. Do you recommend the use of sewer tile, or cast iron soil pipe?

2. Where possible to obtain the desired fall, what grade do you give the pipe per 100 ft. in length

3. Do you make any allowance in the size of sewers or drains to take care of intermediate connections?

4. Where you have angles in the sewer or drain, do you recommended or use elbows, long bends, increasing bends, crosses or brick turns? If so, state reasons for use of recommendations.

5. Where it is necessary to have trap in pipe line, do you use or recommend the use of clean-out traps? If so please give reasons.

6. In laying drain where foreign matter is likely to enter and choke the pipe, do you make any provision to guard against such? What are your methods?

7. Where you lay drain or sewer tile in soft earth or marsh, what method do you use to prevent pipe from settling and forming pockets in the line?

8. Where sewer or drain pipe is laid by contract, do you place an inspector on the work during construction, or make inspection after the line is completed?

9. After laying a sewer or drain, do you make a test of any sort to locate defects in the line? If so, give your method of testing.

10. In laying cast iron sewer or drain, do you find it necessary to completely fill the bell joint with packing and lead?

11. What do you use for packing pipe joints before leading?

12. What portion of the bell joint of the pipe do you fill with packing?

EXTRACTS FROM LETTERS RECEIVED

E. B. Ashby, Chief Engineer, Lehigh Valley R. R.:

1. Cast iron where subject to heavy pressure; elsewhere sewer tile.
2. Grade not less than six inches in 100 feet.
3. We make allowance for intermediate connections.
4. Long bends to prevent reduction of flow.
5. Yes.
6. Frequently use large wire mesh at entrance.
7. Sometimes lay on planks or make cradles of stone.
8. Try to inspect as work progresses.
9. Not unless flow is restricted.
10. No.
11. Usually use a clay if anything.
12. Generally none.

J. Dupree, Superintendent Water Department, Chicago, Terre Haute & South-Eastern Ry.:

1. In soft earth I use cast iron pipe; elsewhere sewer tile.

2. I increase size of main at intermediate connections.

3. Grade 2½ to 3 inches per 100 feet.

4. Where practicable I use brick turns. My reasons are that I can start at any angle from a brick turn, and use this turn as a catch basin. Elbows and long bends will stop up.

5. Where necessary to use trap in pipe line, I always use cleanout trap.

6. Where an unusual amount of foreign matter exists I make use of catch basin; also use a screen and clean out the catch basin when necessary.

9. I hardly believe it necessary to make a test if the line is laid according to specifications.

10. In laying cast iron sewer or drain it is not necessary to completely fill bell joints with lead and packing where there is a good foundation. With sewer tile I fill the joints with cement or mortar.

12. The bell joints of soil pipe are about 3 inches deep, and if the earth or marsh is very soft I use 1½ inches of lead. Where I have clay or solid earth for the line I use only one inch of lead and caulk. Care must be taken in caulking cast iron soil pipe, as it is very easily broken.

C. R. Knowles, General Foreman Water Works, Illinois Central R. R.:

1. Specifications for sewer tile should specify tile to be constructed of standard thickness, good quality of vitrified pipe, salt glazed and well burned throughout its thickness, impervious to moisture, of smooth and well glazed exterior and interior surfaces, free from cracks, flaws, blisters, fire checks, and other imperfactions. Pipe to be laid in trenches fifteen feet deep, or deeper should be extra strong.

2. Area of trunk or main sewer should be equal to the area of all intermediate connections, of course allowing for difference in velocity of flow.

3. Pipe should be allowed a minimum fall of two inches per 100 feet.

4. Long bends are more desirable on account of less interruptions to flow, than elbows or right angle short bends, except where a brick turn is made, which may be made to act as a cleanout basin.

7. In laying a drain or sewer in soft earth or marsh, the bottom of the trench should be floored and the trenches should be kept free from water. No sewer should be laid in water.

10. If conditions are severe enough to justify the use of cast iron pipe, the joints should be entirely filled with jute and lead and caulked as in laying water pipe.

11. Jute or oakum for cast iron pipe.

12. Joints should be filled in the same manner as in laying water pipe, when cast iron pipe is used, leaving 1½ inches for the lead.

Cement for Joints.—A good mortar for cementing the joints of sewer pipe should be made of a mixture of one part Portland cement and two parts clean sand. This will also answer for cementing joints in cast iron pipe when not subject to pressure or strain.

Joints.—The cement should be pressed into the space between the socket and spigot so as to fill it completely, and a level joint at the end of socket should be made. After a joint is completed care should be taken not to disturb the pipe.

Moses Burpee, Chief Engineer, Bangor & Aroostook R. R.:

1. Either sewer tile or cast iron pipe, according to circumstances.

2. I think not less than 1 per cent.; more is better.

7. I recommend in soft ground to lay cast iron pipe with the ends resting on posts driven firmly into the subsoil, if not too deep. If the latter, wrought iron pipe laid on a cradle or planks.

8. I think inspection after laying and a severe test, with guarantee of contractor, the best.

I. O. Walker, Assistant Engineer, Nashville, Chattanooga & St. Louis Ry.:

6. Where sewers drain turntables and engine pits, my personal practice is to put some kind of netting over the inlet so that only the very finest matter can pass into the drain. This is very necessary at such places, because engine wipers invariably drop waste, which, I believe, is the worst thing that can get into a drain.

A. M. Griffin, Architect, Nashville, Chattanooga & St. Louis Railway:

6. I construct catch basins with removable cast iron top at intermediate points, with the bottom about 12 inches below the flow line of the sewer.

7. We use cinders on a concrete base.

8. Where the ditch can be left open we usually make inspection after completion, but otherwise use an inspector.

9. We use a water test of 25 lbs. on cast or wrought pipe work, but on sewer tile we make no test.

R. J. Bruce, Superintendent of Buildings, Missouri Pacific Ry.:

7. I would prevent pipe from settling and forming pockets in the line by either removing the sand or marshy earth or by putting timber under the line to hold it in surface.

10. Where cast iron pipe is laid I would use lead the same as for water pressure.

11. Would jute to bell then lead.

12. Jute to lead recess.

Where a pipe line comes near the surface of a driveway cast iron pipe should be used to avoid breakage. It is good practice in installing a sewer line 12 inches in diameter and up, to provide manholes at all points where change in direction is more than 45 degrees. The character of sewage that is to be taken care of should regulate the distance between manholes, and where much paper or rubbish finds its way into the sewer the outlet pipe at the manhole should be provided with a suitable strainer.

C. H. Fake, Chief Engineer, Mississippi River & Bonne Terre Railway:

7. Have not had any experience in such places, but think I would try laying the pipe on a bed of cinders.

8. An inspector on the job, and he must not be off or get off of it while the men are at work.

9. No, unless city ordinance requires a test and then it is made to conform to ordinance.

W. H. Courtenay, Chief Engineer, Louisville & Nashville R. R.:

1. We ordinarily use cast iron pipe under buildings, platforms, and other places where the pipe would be difficult of access in case of breakage or other trouble.

7. Wooden trestles, wooden cradles, concrete cradles.

8. Generally an inspector, sometimes an inspector and final inspection.

9. Not ordinarily. In buildings we usually specify that the drain shall be stopped at the lower end and filled with water to the roof line.

C. A. Lichty, Inspector, Chicago & Northwestern Ry.:

1. With perhaps few exceptions, ordinary vitrified bell jointed sewer pipe with cemented joints will answer for railroad sewers, unless the sewage has to be disposed of under pressure to a higher level, in which case cast iron pipe might have to be employed.

2. Sewers should have no less than two and one-half inches fall per 100 ft., and more if it can be obtained.

4. Where a bend or sharp turn occurs in the line, a manhole should be constructed; this will permit of the free use of sewer rods or chains when it becomes necessary.

7. Where pipes are laid in soft ground or marshes it is often necessary to support them on a layer of boards or planks and in special cases it may become necessary to support this layer of wood on posts or cross-timbers.

8. To insure good results sewer work should receive careful inspection during construction.

9. It is poor policy to try to correct defects after a sewer has been built, and careful inspection of the work should be insisted upon during construction.

Extensive Improvements at London, Ont.

At London, Ont., the citizens have authorized the issue of debentures for an amount of $400,000 for storm-water drainage construction, also $25,000 for a length of reinforced concrete faced river embankment.

Plans for these proposals are in skeleton form and working plans will be completed during the winter months with a view to letting contracts and starting construction at the beginning of next spring. The storm-water proposals will probably be spread over four years, with an annual expenditure in the vicinity of $100,000. This also means the commencement of an extensive paving programme for the city, which is badly needed.

Proposals are now in hand for starting the laying of two and one-half miles of asphalt paving, to be carried out next season. Several sections of brick paving will also be laid.

A $75,000 extension of the existing sanitary system with a disposal plant for the eastern district, where extensive factories are locating, will be considered this winter and work commenced next year.

Mr. Willis Chipman, of Toronto, is the consulting engineer for the above work, which will be carried out under the supervision of Mr. W. N. Ashplant, the City Engineer.

In all probability tenders for the supply of ironwork, gulley gratings, manhole covers, etc., in quantity, will be called for early in the year.

Montreal Builders' Exchange

The opening luncheon in connection with the Montreal Builders' Exchange was held in Cooper's Restaurant on October 29, with Mr. W. Rutherford as chairman. The Quebec Provincial Lien Law was discussed, Mr. J. L. Perron, K.C., M.P.P., being the principal speaker. Messrs. M. Beullac, Gilday, Stinson, T. P. Howard, Col. Smart, and J. Ballantyne took part in the discussion. Complaint was made that, to secure the benefit of the law, supply houses had to notify the proprietors of their having supplied goods to contractors. The result was that firms were placed in a very delicate position, and the law was practically in abeyance. This had resulted in losses to the supply firms. An amendment of the law was said to be urgently needed, and it was suggested that the proprietors should be held responsible for the supplies to a contractor, or that a contractor should take out a guarantee with a company guaranteeing the payment of the account. The discussion was adjourned.

Engineering as a Profession

An Address by Walter J. Francis, of Montreal, before the Engineering Society of the University of Toronto

ENGINEERING is so material, so practical, and so engrossing that it is very difficult to talk about it in the abstract. Moreover, the engineer is known as a man who does things—and one who is doing things is too busy to talk. You will therefore appreciate the greater difficulty experienced by one who is supposed to be an engineer talking in the abstract on such a subject as engineering.

Mr. Walter J. Francis[*]

In order that we may have some appreciation of the subject it is necessary for us to arrive at some definite understanding of the two words "engineering" and "profession," although I cannot promise you that these definitions will entirely sweep away the mist. We all have our ideas what a profession is and yet it might be very difficult for us to name many professions, and, having named them, to state the reasons why they are professions. Probably the first professions that would come to our mind would be law, medicine and theology. Later we should add pedagogy, dentistry, architecture, and surveying. Some even might go so far as to add engineering. The predominating characteristic of all these callings is their protection by law and their recognition as lawfully constituted bodies by the powers that be and by the people themselves. The distinguishing feature of a profession is that it requires its members to have special training and to perform mental rather than physical labor. Custom has decreed that an individual member must earn his livelihood by his chosen profession. The representative society or societies of each profession have a written or an unwritten code of ethics. This code requires, amongst other things, that the remuneration received by a member for his services shall not be in any way contingent upon the result of his work; in other words, the professional man may not share in the profits. Thus, a lawyer may not, theoretically at least, accept a case on the understanding that he will be recompensed only in event of a victory over the opposing party, or a doctor may not perform an operation on the understanding that his fee will be greater if his patient should live than it would be if he should die. Further, the law recognises, more or less, certain fees that must be paid in court for the services of certain professional men—the surveyor, for example. You will doubtless be pleased to learn that the law allows a surveyor six dollars a day for attendance at court, while engineers and other ordinary mortals receive one-dollar-and-a-quarter as an emolument for such service. The standing of the professions in the popular mind is due largely to the character, ability and dignity of the men engaged therein. The societies representing the professions are the result of the interest that the leaders of the professions have taken in order that the professions may be recognised as such by the world at large.

Generally speaking, a man is no longer considered a member of a profession when he ceases to earn his livelihood by the practice of the profession. A dentist leaving his calling to become a vendor of real estate is no longer considered a dentist, although he has had his training and may still be holding his diploma. A doctor may have received all his degrees and may have practised for decades, but let him devote his energies to commercially exploiting, say, some well-tried prescription and the medical profession no longer recognises him as a member. And so we see that the connection of earning that which is needful to purchase food, clothing and the necessities of life is intimately connected with the recognition of a person as a member of a profession. So much for the meaning of the word profession. Later I shall return to the application of the term to engineering as a calling.

It is much more difficult to define engineering. What is an engineer? I confess I have been trying for twenty-five years to find out—and I am still trying. I remember two boys, now both on the list of graduates of this University, arguing about whether a civil engineer should know all about a locomotive or not. One thought he should. I didn't know. The other fellow is now practising surveying. Once I heard a judge of the Supreme Court of the United States struggle with the definition of an engineer in a brilliant twenty-minute speech, and he wound up by concluding that he didn't know anything definite about engineers excepting that they were jolly good fellows. In the daily press we often read of engineers, but before we get through the description we are fully aware that the person referred to drove locomotive No. 522 between two given stations at seventy miles an hour, or that he was the man who turned the throttle valve of the engine in the hold of the excursion boat.

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[*] Mr. Walter J. Francis, C.E., Montreal, was born at Toronto in 1872 and is an honour graduate of the School of Practical Science. One of the earliest positions that he held was assistant engineer in charge of the design and construction of the Toronto Union Station, which cost seven million dollars. He was engaged by the Department of Railways and Canals to design the 65-foot hydraulic lift lock on the Trent Canal at Peterborough, a position which developed into that of principal assistant to the chief engineer of the Canal and included the design and construction of the Kirkfield lift locks. For a description of the hydraulic lift locks Mr. Francis was awarded, in 1906, the Gzowski medal of the Canadian Society of Civil Engineers. In 1907, after carrying out many important enterprises, Mr. Francis went into consulting practice. Since then he has been identified with many important engineering works throughout the country. In 1908 he was engineer to the Royal Commission of enquiry into the Quebec Bridge disaster. In 1909, among other things he made a report on a two-million-dollar hydro-electric proposition on the North Saskatchewan River, near Edmonton. In 1910 he reported on the public utilities of the city of Edmonton, Alta., and made examinations and reports in connection with the Herald Building disaster (Montreal) and other important matters. One of his most recent undertakings is the Moose Jaw water supply. He has been engaged on the water supply problems of the city of Winnipeg and has made an exhaustive report on hydro-electric development on the Ottawa River. He represented the Canadian Society of Civil Engineers on the committee which undertook the revision of the Montreal building code. Mr. Francis is a member of The Canadian Society of Civil Engineers, The Institution of Civil Engineers (England) and other professional bodies.

The term "engineer" is very much overworked. It is not surprising that the great public gets confused in the multiplicity of engineers that are sometimes referred to. There engineer, the publicity engineer, the mining engineer, the chemical engineer, the structural engineer, the bridge engineer, the elevator engineer, the harbour engineer, the stationary engineer, the government engineer, the city engineer, the town engineer, the tunnel engineer, the county engineer, the marine engineer, the railway engineer and the consulting engineer.

Mr. Dunn, President of the American Institute of Electrical Engineers, in Boston, last year, referred to twenty-seven recognised classes of engineers, and I understand that someone of a statistical turn of mind has succeeded in isolating over one hundred and ten separate and distinct varieties of the bacterium, "engineericus universalis." Is it any wonder the public gets confused?

The Engineer in the Background

Compared with the professional men of law, medicine and theology, the engineer never comes to the attention of the public as a learned man doing things. Let a man be a member of one of the other professions and as soon as he begins to accomplish things he will be heard of. Let the geologist make a speech on his chosen subject and the newspapers of the land will blaze forth with startling headlines that Professor Geologus has unlocked the great secrets which Mother Earth has hidden in her bosom for millions of years. Professor Haultain accounts for this by the fact that the geologist takes time to tell the people what he is doing and what he thinks he has discovered. Let the lawyer defend some celebrity, whether famous or notorious, and before many hours the whole world will know it and will be gazing upon indifferent pictures of that lawyer. I think I am safe in saying that the engineer may devote his life to the service of the world, and die doing his duty, and yet never be heard of during his career, unless he unfortunately makes an error in judgment. I venture to suggest that the Quebec Bridge was more widely known by its failure than it or any other bridge will be in its success. I do not know that the engineer cares particularly about publicity, for he is too busy doing things. I am referring now only to the recognition or non-recognition of his professional existence by the great public. Anyway, he is too busy doing things to stop for the sake of publicity. One of the powers that the engineer under-rates is the power of the press. Summing up, it would appear that the public has, at the best, a very hazy idea of what engineering is. Every engine-runner of the country is an engineer, no matter whether he operate a locomotive or a threshing engine. Even the plumbers try to play on the title and have in our own country succeeded in getting an association incorporated under the name of The Canadian Society of Sanitary Engineers. All respect to the man who can wipe joints and collect his bills of world-famous magnitude, but it looks very much like trespassing on the dignity of the name of the great recognised engineering body of Canada, The Canadian Society of Civil Engineers. It is, indeed, a most fortunate thing that the motorman does not term himself a street car engineer, that the chauffeur does not call himself an automobile engineer, and that the aviator does not wish to be known as a monoplane or biplane engineer. I was just wondering, if the analogy were carried on, what the man would call himself who runs a wheel-barrow.

In every country there are recognised engineering societies having for their object the betterment of the profession and the uplifting of its members, all of whom are required to have certain pre-requisites of training and experience. In Canada there is The Canadian Society of Civil Engineers; in Great Britain, The Institution of Civil Engineers. In the United States The American Society of Civil Engineers takes a corresponding place, with, however, the addition of very strong societies known as the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Mining Engineers. We have in Canada, also, The Mining Institute of Canada. In the constitution of The Canadian Society of Civil Engineers and of The Institution of Civil Engineers the art of engineering is defined, but so far as I know, no definition is given by the other bodies I have named. The definition used by The Institution is that devised by Tredgold, well nigh a century ago. He calls engineering "the art of directing the great sources of power in nature for the use and convenience of man." The Canadian Society of Civil Engineers has based its definition on the same formula in the words "the profession whereby the great sources of power in nature are converted, adopted and applied for the use and convenience of man." With definitions such as these given us by two of the leading English-speaking engineering organisations, it is not surprising that the public has some difficulty in comprehending what an engineer really is, that is, assuming that these definitions ever reached the public. I think it may fairly be said that you could not be considered much of an engineer when you first learned to overcome the law of gravity and stood on end to direct that great source of power in nature to your use and convenience. It has truly been said that the greatest source of power in nature is the tongue of woman, nevertheless, to your engineering ability could not be applied any other definition than that of "contriving" when you succeeded in getting your mother to persuade your father to buy your first rubber boots. We are told that this definition of Tredgold was primarily intended to distinguish the military engineer from the civil engineer. I think there might be some difficulty in endeavoring to apply Tredgold's definition of a civil engineer to the military engineer because that military engineer would not find it easy to convince his enemy that the cannon balls were for the use and convenience of the said enemy, even if there were any enemy left to argue with. Maybe my lack of soldier enthusiasm prompts the remark. The conflicts for the necessities of life are surely serious enough without adding other struggles blazing with uniforms, glittering with cold steel and reeking with blood. But we must not forget that in the olden days much of what is now known as "public work" was done under the direction of the military authorities who possessed the only complete organization of the time.

"Engineering" Defined

Professor Swain has given, perhaps unconsciously, a definition which, it seems to me, excels all others, where he calls engineering "the application of the laws of nature, the principles of mechanics and materials of construction to the business of the world." It seems to me that in these words we have a definition of engineering in its broadest sense.

This definition brings me right up to the present moment, speaking to you as a body of young men who have entered one of the great engineering schools to learn something of how to apply "the laws of nature, the principles of mechanics, and the materials of construction to the business of the world." You have, I repeat, come to a great institution. Its graduates are to be found everywhere making good. Go from Tyrrell on the north to Laschinger on the south, start with

Lash in Java and encircle the world, and you will find the alumni of Toronto. I myself am proud to be on the same list as Duggan, Stern, Thomson, Wright, Ross, Deacon, Mitchell, Fairbairn, Speller, Angus, Chalmers—I should not have started to name them personally, because I want to name them by the hundreds—an honour list of which everyone should be proud. It has been said of Sir Christopher Wren in St. Paul's, "If you would see his monument look around you." I say to you—and I say it with pleasure in his hearing—if you would see the monument of John Galbraith just look around the world at the engineering alumni of Toronto.

The definition necessarily implies broad-mindedness. You cannot be a good engineer and be narrow-minded. So do not forget that this broad Dominion has other universities, older ones in the Old East and newer ones in the New West. Queens and McGill are great universities. There are many great universities in the States. England has a great number of the highest engineering schools in the world. So has France. Germany was well advanced with engineering training before some of the other countries began to be serious about it.

But your university training will not make you an engineer. It will equip you to become an engineer—if the engineering spirit were born in you. By hard work and the application of the training you will here receive you will, I trust, all become engineers.

Now I have discussed professional standing, and I have discussed engineering, and I have discussed university training. You are now doubtless realizing the difficulties surrounding "engineering as a profession." If you eliminate all those engineers who share in the profits of their labours, you will see that you come down to a comparatively small number of men—small as compared with the number composing the profession of law or medicine. Yet you cannot say that those you have eliminated are not engineers. On the contrary they are engineers in every sense of the word and they are so recognized by all the great national engineering organizations. Many of the leading ship-builders, bridge-builders and contractors are amongst the best engineers of the world and they are occupying the topmost positions of honour in the engineering world.

The idea of a part of the engineers taking a stand shoulder to shoulder with the other professions is growing fast. Already a powerful movement is taking place in this direction, and it is interesting to note here that the indefatigable secretary of the only really professional organization of engineers was a member of the class of 1884. I refer to Eugene W. Stern, Secretary of the American Institute of Consulting Engineers.

Let me, in passing, call your attention to the pre-requisites of membership with these professional engineers. A member must be at least thirty-five years of age, he must be actively engaged in the independent practice of the profession, he must be a full member of one of the great recognized engineering bodies, he must have a high character, he must have attained a degree of eminence in the profession, and he must not be engaged in contracting.

When you come to realize the requirements for admission to any of the great recognized engineering bodies and add to them all the other stipulations I have named, you will see that the standard set up by the American Institute of Consulting Engineers is one of which the engineering world should be proud. The membership is jealously guarded, and, of course, it is not great in numbers. At present I think there are less than seventy. You will be especially interested to know that of these one of every sixteen is a graduate of Toronto. This organization illustrates to some extent the difficulties surrounding "engineering as a profession." One is forced to conclude that "engineering" is too great and too comprehensive ever to be confined within the narrow limits of a "profession" in the same way as law and medicine. As it looks at present we should associate ourselves with the recognized engineering bodies first and, later, if our choice take us in that direction, with the Institute of Consulting Engineers. In the meantime study the work that the Canadian Society of Civil Engineers is doing.

The Engineer a Producer

As I look at the whole question, there are, in this world, two classes of people: the producer and the non-producer, and you will see before I get through that I am somewhat of an optimist. At the bottom of the non-producers I place the real estate men and the speculators. At the top of the producers I place the agriculturist and the engineer. Between these extremes live all the other callings and I shall leave you, each for himself, to place them according as they may in your judgment be producers or non-producers. Under our present social system the agriculturist must come first, because we must have food and clothing. Next in order in the world's progress is the engineer. The Indian in his native state, the Arab with his caravan,—these have no need of the engineer. The farther we get from the primitive the greater the need of those who are able to apply to our use and convenience the great sources of power in nature. The marvellous advance of the last century are engineering advances. The other professions are older than engineering. Art is centuries old, yet it is a question if the art of today is on the same plane as that of Greece and Rome centuries ago. The greatest examples of the work of modern architects are based on the ancient orders, and the advances of architecture in modern times are due to the engineer in introducing steel skeletons and reinforced concrete. In surgery wonderful progress has been made within a lifetime, but the skill of noted surgeons was developed only through the medium of the engineer's handiwork in fine instruments and electrical appliances. The physician heals the sick and deals with individuals, while the engineer holds in his hand the health of towns, cities and nations. The preacher has no particular use for the engineer excepting as illustrations in sermons. The lawyer lives on the engineer's quarrels and on the relations which by its ingenuity he has set up between others. The teacher helps to prepare the embryo engineer for his admission into a cold-blooded world and promptly forgets him in the further pursuit of embryology.

It is the engineer who harnesses the Niagaras of the world to transform the night of our cities into noon-day and to turn the wheels of commerce. It is the engineer who develops the mining and furnishes the metal with which he builds machines that by their ingenuity compel us to stand in awe and admiration. It is the engineer who produces the steel that forms a network of highways over our continents and that makes possible the myriads of floating palaces on our oceans. It is the engineer who has abolished famine and pestilence. It is the engineer who has annihilated distance with his telegraph and his telephone. It is the engineer who has made possible the conquest of the air. It is the engineer who places in the hand of the president of a nation the power whereby he is able with a touch to remove from a point thousands of miles away a barrier of nature separating two oceans. It is the engineer who furnishes the worker in the golden west with the machines whereby millions of bushels of wheat are each year made ready to enter the hopper that the engineer has constructed. It is the engineer who has made the Canada of today what she is.

Mather & Platt turbine pumps, for which The Canadian Allis-Chalmers Company, Toronto, have the exclusive manufacturing rights for Canada, are described in a catalogue, a copy of which has just reached us. These pumps are adapted to widely diverse conditions and are in successful operation in many departments of municipal and industrial use. The applications of the pumps are well illustrated in the catalogue.

Mainly Constructional

The News in Brief—From Coast to Coast

Mr. Le Marquand, president of Starland, Limited, Winnipeg, has concluded an arrangement with P. Turner Bone, of Calgary, involving the erection of a theatre building on a lot at Eighth Ave. and First Street East in Calgary, to cost about $500,000.

Owing to the difficult nature of the foundations for a pumping station for the city of Montreal, the contractor notified his desire to be relieved of further responsibility, and the controllers thereupon arranged with the Foundation Company, Limited, Montreal, to complete the work.

The Ritchie Contracting & Supply Company, Limited, have been awarded a contract to furnish two submarine drill boats of the "Sullivan Type, S V 14" required for deep sea drilling in the proposed government dock excavating at Vancouver under contract to Messrs. MacAfee, Henry & McDonald.

The Barnett, McQueen Company, Limited, of Winnipeg and Fort William, have been awarded contracts for the international storage elevators to be erected at Saskatoon and Fort William, to cost almost one million dollars each. The Barnett McQueen Company was the lowest of four tenderers by nearly three thousand dollars.

Without asking for tenders, the Montreal Board of Control have decided to accept an offer of the Elder Elbano Asphalt Company to supply all the asphalt required for 1914. This will allow the city to start paving work early in the spring. The price is $26 per ton, and in the opinion of the controllers the offer is the best ever made.

Contracts have been given by the Federal Government for the construction of a revetment wall and the building of a stretch of roadway to connect the river road near Laprairie with the new stretch of the King Edward Highway. When this work is done the highway will be complete from St. Lambert to the boundary beyond Lacolle.

Seventy new cottages are in course of construction and will be completed this fall on what is known as inter-city property owned by the Canadian Resources Company, Limited, between Fort William and Port Arthur. The dwellings are being rented as soon as completed at a nominal charge of $15.00 a month; many of them have been spoken for weeks in advance.

In the article relating to constructional operations at Regina published in our issue of October 15th, Messrs. Cotter Bros. were erroneously given as the contractors for the Connaught School. We are informed that the general contractors are The Parsons Construction & Engineering Company, Limited, and that Messrs. Cotter Bros. are the contractors for the plumbing and heating.

Representatives from almost every municipality in the Ottawa Valley attended the first meeting of the Ontario Good Roads Commission held last week at Ottawa. There was general agreement as to the necessity of having a permanent government commission to supervise all road construction, and to investigate and apply successful new methods. The Commission is made up of Mr. C. A. Magrath, chairman; Mr. A. M. Rankin and Mr. W. A. MacLean.

The plans for the new Jubilee Hospital at Victoria, B.C., which had been amended in several particulars by the architect, Mr. Loring P. Rixford, have been finally passed by the directors. The estimated cost, on a basis of 28c per cubic foot of building, and including architect's fees, is $399,840. The new structure will include the following buildings: Administration building, two public ward biuldings, laundry and power house, and service building.

The Thor Iron Works, Limited, of Toronto, have been awarded the contract for the standpipe at Timmins, Ont., by The Canadian Mining and Finance Company, Limited. The standpipe will be 20 feet in diameter and 95 feet high, with a total capacity of 225,000 gallons. Of this capacity, 50,000 gallons will be held as a reserve for fire protection purposes at the top of the standpipe by installing a hemispherical bottom about fifteen feet from the top. The standpipe will be erected before the severe weather begins.

The Amalgamated Engineering Company is reported to be arranging to start work on the drydock and ship-building yards project at North Vancouver within thirty days. They will occupy the eighteen hundred feet of waterfront lying between Fell and McKay avenues. The Amalgamated Engineering Company will be assisted by the Dominion Government by a guarantee of its bonds. The cost of the proposed works is estimated at four million dollars, 99 per cent. of which expenditure will be made in North Vancouver.

Mr. J. D. McArthur, contractor for the Hudson Bay Railway, denies the statement that the railway will not be completed until 1916. He stated that the rails would be laid to Fort Nelson in 1915 and that the line would be in operation by the end of that year. Track-laying this year had proceeded slowly owing to the shortage of ties, but the rails would be laid on the first division this year and 200 miles thereby completed. With regard to the Edmonton, Dunvegan and B. C. Railway, Mr. McArthur said two hundred miles of grading had been accomplished and over one hundred miles of steel laid.

The city council of Victoria, B.C., recently considered a final report on awarding the contracts for various phases of the Sooke waterworks system. The contract for the rivetted steel pipe was tentatively awarded to MacDonald Godson Company, of Vancouver, at $440,000, and it is now understood that Jones & Rant, of Victoria, are preparing to oppose this award. The latter firm's tender was originally $398,000, but this did not comply with the specifications and was rejected. For the concrete flow line the Graff Construction Company, at $308,000, was the lowest, with the Pacific Lock Joint Company next lowest, at $329,000.

The Vancouver ferry subway, for which proposals are invited, will cost about $35,000. The subway will be 25 feet wide, and will have nine feet clearance, with a ramp leading down from Alexander street and another leading up to the wharf. The retaining walls of the ramps will be of reinforced concrete, while immediately under the tracks there will be a steel roof. The supporting walls of this will be of solid concrete. The steel roof of the subway will be located about three feet six inches beneath the tracks of the C. P. R. The floor of the subway will consist of solid concrete reinforced by steel rods, and 18 inches thick.

To members of the Prince Albert Board of Trade was recently outlined plans for a large undertaking already launched upon by the National Iron and Steel Corporation, which, according to Mr. Jas. Kreis, of Chicago, consulting engineer for several large United States corporations, inside of four years will be employing fully five thousand men. The plant is located in the west end of the city, where the work of erecting the factories has already been commenced. A twenty-inch bar mill and horseshoe factory, which are the first two units, are already under way. Later a sheet mill galvanizing plant, a foundry for steel castings and a tube factory will be added. Mr. Kreis estimated that by then the corporation will be using at least 4,200 horsepower from the new city power plant now in course of erection at Lacolle Falls.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Listowel, Ont.

Water mains planned by the Town Council on Wells, Erie, Wellington, John and Ross Streets. Mayor, Wm. Climie.

London, Ont.

Sewers planned by City Council on Ridout St., Cove Rd. and Regent St. Mayor, C. M. R. Graham. Engineer in charge, W. N. Ashplant.

Sewers, cost $400,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting Engineer, Mr. Willis Chipman, Mail Bldg., Toronto. Working plans to be completed during winter with a view to letting contracts and starting construction in spring. Work will likely be carried out under supervision of Engineers Dept. Tenders for supply of iron work, gulley gratings, manhole covers, etc., in quantity, will be called for early in 1914.

Extension to sanitary sewer system, cost $75,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting Engineer, Mr. Willis Chipman, Mail Bldg., Toronto. Matter to be considered this winter and work commenced next year. Extension to system with disposal plant for the Eastern District.

Ottawa, Ont.

Sewer, intercepting, cost $75,000, planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Tenders close November 6th. Quantities: Earth excavation 12,000 cu. yds. Rock excavation 3,092 cu. yds., brick and concrete sewer 3,985 lin. ft., tile pipe underdrain 3,935 lin. ft., 6-in. drain connections 100, 9-in. drain connections 20, both to include stoppers, 12-in. connections for sewers 10, manholes 12, connection chamber 1.

Sewer, cost $2,500, Queen St., planned by City Council. Mayor, J. A. Ellis. City Engineer, Archibald Currie.

Sewer, cost $50,000 to $80,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Tenders will be received by Sec. Board of Control until 4 p.m. Nov. 6th, for construction of the West End Intercepting Sewer. Specifications, etc., at office of City Engineer.

Quebec, Que.

Street improvements, cost $600,000, planned. Mayor, Nap. Drouin. City will be authorized to ask Legislature to borrow the above sum for the paving of streets, new ornamental posts, etc., in Montcalmville.

Regina, Sask.

Tenders received until Nov. 10th for steel roof for filter bed at Sewage Disposal Works. Engineer, F. McArthur. City Commissioner, L. A. Thornton

Stamford Twp., Ont.

Waterworks, cost $30,000, planned. Clerk, Carleton Munroe, Southend. Engineer in charge, Carl Gardner, Niagara Falls. Council will receive tenders on Duplex pumps, capacity 300 gallons per minute, automatic controls, pipe, valves and standpipe to hold about 180,000 gals.

Sarnia, Ont.

Waterworks and sewer system, cost $16,000, planned by Town Council. Mayor, Dr. Bell. By-law carried by ratepayers Oct. 24th.

Toronto, Ont.

Commr. of Works, R. C. Harris, recommends sidewalks on Benlamond, Heath, Elmer, Renhold and Ritchie. Estimated cost $8,192. Asphalt pavements on Cornwall and Renholt, cost $4,927. Brick on lane off Dovercourt, north of Dundas, $5,905.

Commr. of Works, R. C. Harris, recommends asphalt pavements, Hugo Ave. $2,374, Agnes $17,442, Seymour $8,558, Armoury $4,83,7, Tyrrel $17,413. Brick block on St. Clair W., $13,802.

Pavements planned by Board of Control. Asphalt on Dunn Ave. and Wolseley, to Constructing & Paving Co., Confederation Life Bldg., $11,501; Beaumont, Bellair, Browning, Carlaw, Cumberland and Elliott Sts., to Godson Contracting Co., Manning Chambers, $41,847.

Commr. of Works, R. C. Harris, recommends construction of tile pipe sewers in number of lanes. Estimated cost $5,330.

Winnipeg, Man.

Pavement, St. Charles. Owner, Rural Municipality of Assiniboia. Tenders received by Clerk, Frank Ness, Kirkfield Park, P.O., till November 25th, for asphalt pavement on Portage Road in Lot 113. Approximately 7¼ miles, the first 1¼ miles to be 24 ft. wide, the balance 16 ft. wide. Plans and specifications at office of Engineer, Municipal Hall.

Watermains planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. Dunfra ave., McGregor to 300 ft. of Copp St. McGregor St., Armetta to Dunfra Ave. Armetta Ave., McGregor to Copp St. Specifications, etc., at office of engineer. Tenders received till November 4th.

Tenders received by Board of Control till Nov. 1st for water mains in Cameron St. from Talbot to Reach Ave., Beach Ave. from Molson Bridge C. P. R. to Green St., Talbot Ave. from Cameron to Kent St. Specifications at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Regina, Sask.

Additional filter bed, cost $14,700, at sewage disposal works, planned by City Council. Engineer, F. McArthur. City Commr., L. A. Thornton. General contractor, O. W. Smith, Peart Block.

Three Rivers, Que.

Paving planned by the Municipal Council. General contractors, Cote & Michaud, Quebec, Que. 20,000 yards.

Timmins, Ont.

Standpipe for Canadian Mining & Finance Co., Ltd. Engineer, Company's staff. General contractors, Thor Iron Works, Ltd., Foot of Bathurst St., Toronto. 95 ft. high, 20 ft. in diameter, with total capacity of 225,000 gallons. To be erected this year.

Toronto, Ont.

Concrete curbings. General contractors, Constructing & Paving Co., Confed. Life Bldg., Wolseley St., at 41c per ft. General contractors, Godson Contracting Co., Beaumont, Bellair and St. Nicholas St., at 41c. General contractors, National Contracting Co., 9 Garnock Ave., Avondale Rd., at 40c.

Cast iron pipe required by Board of Control. Mayor, H. C. Hocken. 36 in. pipe. General contractors, National Iron Works of Toronto, at $7,325 per length for delivery in Section "A," Can. Allis-Chalmers Ltd., at $7,320 per length for delivery in Sections B and C. 20 in. pipe. General contractors, National Iron Works of Toronto, at $4,080 per length.

Street grading planned by Board of Control. Mayor, H. C. Hocken. Howick and Rosethorn to Grant Constructing Co., Front St. E., $2,465. Tennis Cres. to Routley & Summers, Benlamond Ave., $2,922.

Asphalt pavements planned by Board of Control. Butternut and Jackman Ave., to Contracting & Paving Co., $18,296; Dufferin, Huron and Knox, to Godson Contracting Co., $13,489; Homewood Ave., to Commr. of Works, day labor, $9,417.

Winnipeg, Man.

General contractors, Thos. Jackson & Son, 370 Colony St., for sewer pipe and specials, cost $30,183. Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Hydrants planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractors, Rensselaer Valve Co., Troy, N.Y. 150 6 in. hydrants each $37.50.

Water mains planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction, City Yards. Sewer in Sargent Ave., $2,274.50; water mains in Kent St., $99.20; Sargent Ave., $176; Wall St., $275.75; Sherburn St., $291.44.

Railroads, Bridges and Wharves

Province of Alberta

G. T. P. Rly. has been authorized to construct spur and sidings for Pembina

Coal Co., Ltd., in Sections 19 and 30-53-7 W.5.M. Alta.

Bassano, Alta.
C. P. R. has been authorized to construct spur for Imperial Oil Co., Lot 1, Block A, of Bassano & Calgary Brewing & Malting Co., Ltd., Lot 2, Block A of Bassano.

Beeton, Ont.
G. T. R. has been authorized to reconstruct bridge No. 278 at mileage 73.75 13th Dist., over Nottawasaga River, near Beeton.

Province of B. C.
C. P. R. has been authorized to construct bridge No. 117.42 Shuswap Sub. Div., B. C. Division.

Calgary, Alta.
C. P. R. has been authorized to construct spur for Calgary Stock Yards Co., Ltd., in N.E. ½ Sec. 11-24-1 W.5.M., Alberta.

Fitzroy Harbour, Ont.
C. N. O. Rly. has authorized construction of bridge to carry railway across Ottawa River at Fitzroy Harbour, Twp. Fitzroy and Onslow Cos., Carlton and Pontiac, Provinces of Ontario and Quebec, mileage 37.32 west of Ottawa.

Fort William, Ont.
Quay wall, etc., Mission River, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders close Nov. 21st. Plans, etc., at office of Dept. and W. P. Merrick, Fort William, J. G. Sing, Esq., Toronto, J. L. Michaud, Montreal. Quay wall 2,646 ft. long, sq. timber cribwork filled with earth and stone, concrete superstructure, British Columbia fir, spruce, hemlock, white or red pine, approximate quantity of materials: lumber 4,822,900 ft. B. M.; drift bolts 319,629 lbs.; screws, bolts, etc. 152,261 lbs.; lift rings 12,336 lbs.

Halton, Ont.
G. T. R. has been authorized to construct siding into premises of Canada Brick & Fireproofing Co., Ltd., on part of Lot 27, Con. 11, Twp. Esquesing Co., Halton, Ont.

Islington, Ont.
C. P. Rly. has been authorized to construct siding into premises of D. L. Streight, Lot 7, Con. A., Twp. Etobicoke, Co. York.

London, Ont.
Breakwater, cost $25,000, West, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting engineer, Mr. Willis Chipman, Mail Bldg., Toronto. Plans to be completed during winter with view to letting contracts and starting work early in spring.

Musquash, N.B.
C. P. Rly. has approved of station at Musquash, Parish of Musquash Co., St. John, N.B., mileage 66.41 on Co.'s Shore Line Sub. Div., Atlantic Dist. No. 1.

North Sydney, N.S.
Tenders received by Sec., L. K. Jones, Ottawa, Dom. Govt. Dept. of Railways and Canals, up to and including Nov. 10th, for the construction of a line of railway from North Sydney to Leitches Creek. Plans, etc., at office of Station Master, North Sydney, Resident Engineer, New Glasgow, office of Chief Engineer, Moncton, N.B., and at Dept., Ottawa.

Province of Ont.
C. L. O. & W. Rly. has been authorized to construct bridge over Smithfield Creek, near mileage 93.7 Ont. (Murray-Brighton Road Div).

C. P. Rly. has approved of station on Pt. McNicoll Sub. Div., Ont. Dist. 1, Lot 28, Con. 3, Twp. Ops. Co. Victoria, Ont. Cambray mileage 22.78 and 2 at Franklin mileage 6.3, Lot 22, Con. 12, Twp. Manvers, Co. Durham.

C. N. O. Rly. have approved of stations as follows:—Master, mileage 111.05 from Ottawa, Twp. of Master and Kathmore, mileage 115.3 from Ottawa, Twp. of Master.

Ottawa, Ont.
Temporary bridge, cost $15,000, Bank St., planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Tenders received by Chairman Board of Control until Nov. 4th for bridge over Rideau River, north of present Billings Bridge.

Pelee Island, Ont.
Repairs to docks, cost $3,500, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Engineer in charge, H. B. R. Craig, Windsor, Ont. Plans in progress.

Twp. Pentland, Ont.
Bridge. C. N. O. Rly. has been authorized to construct bridge across Kiosh-Koqui Lake, Twp. Pentland, Nipissing Dist., at mileage 186.6 from Ottawa.

Regina, Sask.
C. P. R. has been authorized to construct spur for J. K. McInnis.

Addition to car barns, cost $20,000, Albert, planned by City Council (Street Rly. Dept.). City Commr., L. A. Thornton. Architect, H. Doughty, Supt. of St. Rly. Dept. Brick construction and foundation, corrugated iron roofing.

Subway, cost $50,000, Winnipeg, planned by City Council, under C. P. R. tracks. Engineer, F. McArthur. City Commr., L. A. Thornton.

Richmond Hill, Ont.
C. N. O. Rly. has been authorized to construct spur to the property of J. H. Dunlop, Lot 24, Con. 1, Twp. Markham, Ont.

St. Catharines, Ont.
Welland canal, cost $3,000,000, Section No. 5. Tenders will be received by Dominion Govt., Dept. of Railways & Canals. Secretary, L. K. Joies, Ottawa, until noon, November 18th. Plans, specifications, etc., at office of Chief Engineer of above Department, Ottawa, and with engineer in charge, St. Catharines, Ont. Section No. 5 consists of three mile division, extending from a point in Port Robinson to a point in about the centre of Allenburg. Comparatively little rock-cutting to be done.

St. Gregor, Sask.
C. N. Rly. Co. has been authorized to erect 3rd class station. Work to be completed not later than July 31st, 1914.

Sudbury, Ont.
C. N. O. Rly. has been authorized to construct spur to mills of Laberge & Sons, from station 4158.7 on connecting track between its line and Algoma Eastern Rly. and across Wilma St.

Twp. Tilbury West, Ont.
Michigan Central Rly. Co. has approved of bridge to be constructed under M. C. R. tracks at mileage 32.98, Little Creek Drain.

Tilsonburg, Ont.
C. P. Rly. has been authorized to construct spur for Tilsonburg Elec. Car Co., Ltd., across King St. and 6th St., at mileage 15.4, Port Burwell Sub. Div.

Toronto, Ont.
High level bridge planned by Twp. of York, over Don River, connecting Leaside and Donlands, near corner of Eglinton and Leslie Sts. Plans not yet approved by Council. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, Adelaide St. E.

CONTRACTS AWARDED

Cardigan River, P.E.I.
Extension and reconstruction of wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Annandale Lumber Co., Annandale, via Georgetown, P.E.I.

North River Bridge, P.E.I.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Jos. Hughes, Charlottetown.

Ottawa, Ont.
Railway planned for Morrisburg & Ottawa Elec. Rly., Can. Life Bldg. Sec., R. S. Bishop, Canada Life Bldg. General contractors, R. J. Tierney Co., Ottawa. Eight miles of line completed.

Pinette Bay, P.E.I. (McAuley's Shore)
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Annandale Lumber Co., Ltd., and T. W. McDonald, Annandale, via Georgetown, P.E.I. 675 ft. long.

Public Buildings, Churches, Schools, etc.

Amherst, N.S.
Police headquarters, cost $5,000, La Planche, planned by Municipal Council. Mayor, J. N. Fage. Clerk, W. J. Donkin. Police Commrs., P. Gordon, H. R. McCully. Two storeys, 40 x 40, stone foundation, brick construction, shingle roofing, electric lighting. Plans in progress.

Belleville, Ont.
Interior alterations to post office planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Maple floors, office fixtures.

Broughton, Que.
School planned by School Commrs. Plans, etc., at office of Sec.-Treas., Jos. Ludger Beaudoin, West Broughton, who will receive tenders for construction of school No. 6.

Forest, Ont.
Steam heating system for Town Hall planned by Town Council. Mayor, H. J. Pettypiece. Tenders will be called.

Hamilton, Ont.
Addition to school, cost $82,000, Stinson street, planned by Board of Education. Secretary, R. H. Foster, City Hall. Architect, A. W. Peene, Clyde Block. Tenders to be called shortly. Two stys., 10 rooms, brick construction, central heating plant, modern ventilating.

Les Ecureuils, Que.
School planned for R. C. School Commissioners Sec. No. 4. Sec., Oliva Auger.

Plans can be seen at office of Secretary who will receive tenders.

London, Ont.
Board of Education are asking for prices for seating in two new schools. Further information from E. R. Dennis, Chairman, Board of Education.

Minnedosa, Man.
Interior fittings for post office, etc., for Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders will be received by Secretary until November 17th. Plans, specifications, etc., at office of T. Blankenstein, Clerk of Works, Public Bldgs., Minnedosa, H. E. Matthews, resident architect, Winnipeg, and at Department, Ottawa.

Montreal, Que.
Post office at Verdun planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Further information from Mr. Gadboury, Montreal.

College contemplated, Cote Des Neiges. Architect, G. A. Monette, 260 St. James St., Montreal, is preparing plans.

School, Shirley, for Protestant Board of School Commrs., 197 Peel St. Architect, F. Belfrey, c/o Commrs. Two stys., concrete foundation, brick construction, felt and gravel roofing. Plans drawn.

Ottawa, Ont.
City Council, Board of Health, plan installation of 100 flush closets in city. Tenders to be called shortly. Mayor, Mr. Ellis. Chairman, Dr. Parent. M. H. O., Dr. Lomar.

Town hall, fire and police station, cost $25,000 to $30,000, planned by Town Council of Eastview. Mayor, C. Gladu, McArthur Rd. Council contemplates raising debentures for above projects, also for the purchase of 2 chemical fire engines (twin tank).

Lanterns required by Dom. Govt. Dept. of Marine and Fisheries. Deputy Minister, Alex. Johnston, Ottawa. Tenders received until noon, Nov. 8th, for supplying 4-7 ft. Standard cast iron lighthouse lanterns, as per plans and specifications, prepared by Dept., to be delivered free of all charges at the Dominion Lighthouse Depot, Prescott, Ont. Plans and specifications from Purchasing Agent of Dept., Ottawa, Agent of Dept., Montreal, and from Collector of Customs, Toronto.

Sisters of Precious Blood, Echo Drive, propose to rebuild the whole of convent, chapel, etc.

Theatre, cost $40,000, planned for H. Brouse, Bank St. Architect, W. Herbert George, Castle Bldg., Queen St. Excavating, mason and foundation, A. Tubbe, 72 Lees Ave. Tenders open for steel and brick work.

Palmerston, Ont.
Post Office, cost $20,000, contemplated by Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Further information from W. A. Clarke, M.P., Palmerston. Red pressed brick and stone trimmings construction, concrete and stone foundation.

Regina, Sask.
Church, cost $20,000, for Anglican Congregation. Pastor, Rev. E. C. Ear, 2300 Smith St. Plans in progress.

Club house, cost $15,000, contemplated by Prov. Conservative Association, New Bank of Ottawa Bldg. Sec., Jas Balfour, 2315 Victoria Ave. Two storeys. Plans will be prepared.

Redcliff, Alta.
Moving picture theatre, cost $5,000, 3rd, for Messrs. Eastland Bros. One storey, 25 x 100. Moving picture theatre equipment required. Walls up.

St. Catharines, Ont.
Hospital contemplated by the Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Site purchased, 23 acres. Hospital will be for accommodation of workmen on new Welland Canal.

St. Janvier de Bainville, Que.
School planned by School Commrs. Plans and specifications at office of Sec.-Treas., Dr. J. W. Brunet, St. Janvier, who will receive tenders until noon Nov. 20th.

St. John, N.B.
Club house, cost $3,000, for Cliff Club, c/o W. H. Thorne, Prince William St., and F. E. Sayre, 24 Long Wharf. Architect, Garnet Wilson, 50 Princess street. Frame construction. Plans in progress.

St. Marys, Ont.
Gymnasium, cost $3,200, planned by the School Board. Chairman Com., Dr. Knox. Architect, W. Fletcher Shepherd, 774 Shaw St., Toronto. Tenders will be received by Chairman. White brick veneer construction.

Swift Current, Sask.
School planned by Town Council. Architects, Reilly, Dawson & Reilly, 512 Western Chmbrs., Regina. Tenders received by Sec.-Treas., J. T. Dodds, for foundation close No. 4th. Plans and specifications with Architect and at 20-21 Russell Block, Moose Jaw.

Toronto, Ont.
Board of Control has authorized M. H. O. to equip a wing of the Old General Hospital for treatment of measles. Chairman Board of Health, Ald. H. A. Rowland, Gerrard and Parliament Sts. Med. Health Officer, Dr. C. J. C. O. Hastings, City Hall.

Truro, N.S.
Hall and offices, cost $25,000, Prince St., planned for Independent Order of Oddfellows. Probable architect, E. D. Vernon, Dominion St. Two storeys; 90 x 60.

Toronto, Ont.
Church, cost $30,000, planned for Royce Ave. Presbyterian Congregation. Treas., Jos. Reid, 9 Hugo Ave. Work may start in spring of 1914. Presbytery has given permission to raise above sum.

Y. W. C. A. building contemplated. Site purchased on Mavety St., West Toronto, and plans will be prepared.

Church at Leaside, planned. Architect, Thos. Livingstone, 2 Leader Lane, Toronto. Tenders close with Architect on Oct. 31st for all trades except heating. Concrete foundation, brick construction.

Winnipeg, Man.
Addition to Broadway Baptist Church, Walnut and Broadway. Pastor, Dr. Sowerby, Walnut and Broadway. Architects, Jordon & Over, Canada Life Bldg. Work will be let in spring. Plans drawn.

Engineering building, St. Vital, planned for Manitoba University Council. Prov. Architect, V. W. Horwood, 261 Fort St., Winnipeg. Constr. Architects, Brown & Vallance, McArthur Bldg., Winnipeg. Three storeys, 200 x 75. Building will have 2 wings, 70 x 40. Two storeys. Tenders will be called early in 1914, and work will start in spring.

Wallace, N.S.
School, cost $7,000, planned. Architect, Willard Mitchell, Amherst. Tenders received by Sec. School Trustees. One storey, 70 x 80, brick foundation, frame and Wallace brick construction, ventilating system, library fittings.

CONTRACTS AWARDED

Amherst, N.S.
School addition, cost $30,000, Acadia St. Chairman School Commsn., B. J. Lawson. Architect, Willard Mitchell. General contractor and plastering, J. E. Lusby. Heating and plumbing, Hagen & Co. Electrical, Jno. Conn, 122 Victoria St. Interior fittings, Ainslie Allen. 2½-storeys, 70 x 70. Lighting, steam heating, ventilating system, ventilators, lime and sand plaster.

Armories, cost $81,100, Agnew-Acadia Sts., planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Rhodes Curry Co., Ltd. Stone and brick will be required at once. Two storeys, 80 x 86, sandstone, reinforced concrete and brick construction, steel trusses and metal, architectural iron stairs. Foundations started.

Belleville, Ont.
Dormitory building planned by Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughton, Toronto. General contractors, Thos. Manley & Son. Plumbing, Purdy Mansell Co., Albert St., Toronto. Electric wiring, Greenleaf & Son, Belleville, Ont. Heating tender in, not yet awarded.

Brantford, Ont.
Dormitory, cost $40,000, planned by Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughton, Toronto. General contractor, Jess Bartle, 172 Darling St. Plumbing, Drake Avery Co., John St., Hamilton. Heating and wiring tenders in, not yet awarded.

Calgary, Alta.
Examining warehouse, 11th Ave. E., planned by Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Ornamental iron, Western Steel & Iron Co., Office Chalmers, Elmwood, Man. Steel work completed, stone work started.

Edmonton, Alta.
Public school, cost $150,000, 3rd St. E. Sec.-Treas., Mr. Brady, Mortlake Block. Architect, Mr. Turner, Mortlake Block. General contractors, Read, MacDonald & Brewster, 604 Tegler Block. Two stys., 116 x 164.

Grimsby, Ont.
Pre. cooling plant, cost $12,000, for Dominion Government, Department of Agriculture. Secretary, A. L. Jarvis, Ottawa. Architect, E. J. Greenstreet, 631 Huron Street, Toronto. General contractor, D. Marsh, Grimsby. Machinery, Madison Cooper Co., New York. Two storeys, 48 x 120, frame construction, concrete foundation.

Hanover, Ont.
Church, cost $20,000, Durham, for Baptist Congregation. Builder and general contractor, Jacob Hahn. Heating and

plumbing, Young Bros. Electrical, Hanover Elec. Light Co. Interior fittings not awarded yet. One storey and basement.

Moncton, N.B.

Church, cost $62,200, Church and Queen, for First Baptist Congregation. Architect, C. B. Chappell, Charlottetown, P.E.I. General contractor, J. M. Clark, 54 Church St. Foundations in.

Montreal, Que.

Theatorium, cost $9,000, Queen street, for A. J. Bentley, Montreal. Architect, F. R. Cowan, Montreal. General contractor, T. Essery, 2277 Hutchison. Excavating done.

Theatre, cost $25,000, Papineau. Owner and general contractor, B. Damien, 894 Mt. Royal T. Architect, J. A. Godin, 269 St. Denis St. 44 x 118, concrete foundation, waterproofing, brick construction, copper cornices, felt and gravel roofing. Permit issued.

Prince Albert, Sask.

Skating rink, cost $35,000, River St., for East Prince Albert Rink Co. Architect and general contractor, T. Manley. 140 x 80, mill construction, concrete and waterproofing foundation, felt and gravel roofing, temperature regulators, ventilating system.

St. John, N.B.

Observatory, cost $25,000, planned by Dom. Govt. Meteorological Service. Architect, Garnet Wilson, 50 Princess St. General contractors, British American Constr. Co., Ltd., Prince William street. Roofing, Jas. McDade, Mill street.

Truro, N.S.

Church, cost $60,000, Young St., for First Presby. & St. Pauls United Congregations. Sec. Bldg. Com., H. A. Dickie, Royal Bank Bldg. Architects, Curry & Sparling, 105 Bond St., Toronto, Ont. General contractors, Wilson's Ltd., Truro. Excavating done.

Windsor, Ont.

Parish hall, cost $7,500, London street, planned by Church of Ascension. Chairman, O. E. Fleming. Architect, Harold Barrons, 38 Curry Ave. Mason, T. Jones. Carpenters and roofing, Irwin & Johnson. Steel and heating, Pennington & Brian. Plastering, Kennedy & Sons. Plumbing, Robert Paddon. Electrical, Dom. Electrical Co. Two storeys, 42 x 50.

I. O. O. F. hall, cost $35,000, Wyandotte. Chairman, Thomas Yates. Architect, J. C. Pennington. Carpenter, Williamson Constr. Co. Three storeys, 52 x 90. Foundations in.

Winnipeg, Man.

School, cost $90,000, St. James, Linfield St., for Rural Municipality of Assiniboia. Sec.-Treas., Frank Ness, Kirkfield Park P.O. Architect, Alex. Melville, Builders Exchange. General contractors, Frid Lewis & Co., Somerset Bldg. Three storeys, 135 x 85.

Yorkton, Sask.

Monastery and church, cost $35,000 for Redemptionist Brothers. General contractors, Newert Construction Co. Two storeys, brick and stone construction, brick foundation. Foundations in.

Church, cost $5,000, for German Lutheran Church. General contractor, T. W. Rahn. Brick construction and foundation. Foundations in.

Business Buildings and Industrial Plants

Belleville, Ont.

Hotel annex, cost $5,000, Front St., for Tom Powers. Four storeys, 20 x 50, pressed brick construction, cement foundation. Plans in progress.

Glencoe, Ont.

Garage, cost $7,000, Main. Owner and architect, Alex. Duncanson. Two stys., 40 x 70, white brick construction, concrete foundation, felt and gravel roofing, store fronts, equipment and tools required. Plans in progress.

Hamilton, Ont.

Addition to factory, cost $5,000, Shaw St. Owners and architects, Boston Insulated Wire Co., Shaw St. Two storeys, brick construction, concrete foundation, felt and gravel, roofing. Plans in progress.

Kilmartin, Ont.

Farm buildings, cost $4,000. Owner and architect, Neil Munroe, Kilmartin, Glencoe, P.O. Concrete foundation, fire proof construction and roofing. Plans drawn.

Leadville, Que.

Saw mill for C. N. Boright, Mansonville. Private plans are being prepared.

Leamington, Ont.

Addition to canning factory, cost $10,000, for Gorman, Eckert & Co., 318 Rectory St., London. Manager, Wm. Gorman. Architect to be selected. Additional equipment to be installed. White brick construction. Plans in progress.

Montreal, Que.

Store and flats, cost $5,000, Maisonneuve (Ontario St.), for Aug. Tetrault, Lafontaine and 2nd Ave., Maisonneuve. Three storeys, 23 x 30, stone and concrete foundation, frame and brick construction, felt and gravel roofing. Plans in progress.

Store and flats, cost $4,800, St. Hubert, for Hector Belanger, 2820 St. Hubert. Three storeys, 25 x 50, concrete foundation, felt and gravel roofing. Plans ready.

Factory, cost $25,000, for C. W. Lowes, Sherbourne St., Montreal. Six storeys Plans ready.

Orillia, Ont.

Remodelling stores, cost $4,000, planned for Mrs. Quinn. Tenders received by architect, J. H. Robinson.

Ottawa, Ont.

Addition to store, cost $3,800, Somerset. Owner and architect, Eugene Hurtubise, 763 Somerset St. Concrete foundation, solid brick construction, felt and gravel roofing, store fronts and fixtures. Plans ready.

Printing plant, cost $40,000, Nepean St., for Lowe-Martin Printing Co., Albert St. Architect, Allan Keefer, 229 Sparks St. Five storeys, reinforced concrete construction, concrete foundation, waterproofed, felt and gravel roofing. Plans drawn.

Stores and residences, cost $12,000, Bank, for Oakland Land Co., c/o Mr. W. J. Spratt, Ottawa South. Two storeys, 50 x 50, brick veneer construction, stone and concrete foundation, felt and gravel roofings. Plans in progress.

Workshop and greenhouse, cost $10,500, John St., for Geo. and Mrs. D. McLaurin, 42 Stanley St. Architects, Lord & Burnham Co., New Arlington Hotel. Brick foundation, concrete and stone, steel frame construction. Plans drawn.

Store, Bank St., contemplated for A. E. Rae Co., Ltd., Rideau St. Architect not yet appointed.

Ridgetown, Ont.

Bank offices, cost $12,000, Main, for Royal Bank of Canada. Manager, W. A. Pow. Architect Kenneth G. Rae, 54a Beaver Hall Hill, Montreal. Two stys., concrete and stone foundation, stone trimmings and Milton pressed brick construction, felt and gravel roofing. Plans drawn.

Addition and alterations to store, cost $4,500, Rideau, for E. C. Grant & H. P. Fleming, 22 Metcalfe. Architect, C. J. Burritt, 193 Sparks St. Stone foundation, brick construction, felt and gravel roofing, plate glass, store fronts and fixtures. Plans drawn.

St. Marys, Ont.

Addition to flour mill planned by Carter Milling Co. Ratepayers will vote on new by-law to grant company loan of $50,000 Nov. 20th.

Toronto, Ont.

Warehouse planned for McColl Bros. & Co., Don Esplanade, now ready to reeive tenders for excavating only.

Warehouse, cost $8,000, Atlantic Ave., planned for Dominion Linseed Oil Co., Kent Bldg. Contracts not awarded until November 5th. Two storeys, 40 x 72, brick and steel construction, brick foundation, felt and gravel roofing.

Alterations to office building for Mail Printing Co., King and Bay. Tenders received by Architect, Gordon M. West, 2 College St., for alterations to main door way, vestibule door, etc.

Restaurant for R. H. Holmes, Philadelphia, Pa., and Toronto. Owner has secured lease of No. 83 Yonge St. Site 20 x 100, and plans will be prepared.

Wilkie, Sask.

Flour mill, cost $10,000, for F. L. Bishop, Strome, Alta. Board of Trade has granted owner free site, and plans will be prepared.

Windsor, Ont.

Alterations to restaurant, cost $3,000, Sandwich St. W., for King Lee, Chatham, Ont. Architects, G. Jacques & Co., Windsor, are preparing plans.
Plans in progress.

Stores and apartment house, cost $40,000. Architects, Watt & Blackwell, Bank of Toronto Bldg., London. Tenders received by Architects. Three storeys, 60 x 40, 80 x 60, concrete foundation, waterprofing, brick construction, plate glass, mantels, store fronts and fixtures.

Windsor, Ont.

Factory contemplated for No Draught Ventilator Co. Secretary, Edw. J. Post, Staunton, Va. Plans will be prepared.

CONTRACTS AWARDED

Belleville, Ont.

Bakery, cost $4,000, Dundas St., for W. Gilbert. Builder, Ira Thompson. Two storeys, 30 x 40, brick construction, shingle roofing, electric lighting, motors and generators. Foundations in.

Edmonton, Alta.

Stores, cost $15,000, Bellamy. Owner and architect, Mr. Montgomery, 9427 Bellamy St. General contractor, Mr. Watt, 598 Kennedy St. Painting, Mr. Hall, Kirkness St. Heating and plumbing, Domestic Engineering Co., 780 Jasper Ave. E. Electrical, Burnham & Frith Elec. Co., McDougall St. One storey, 40 x 172, felt and gravel roofing.

Stores and apartments, cost $20,000, Alberta Ave. Owners, architects and general contractors, Pietz & Schoeffel, 1063 Fraser Ave. Three storeys, 31 x 80, brick construction, concrete foundation, felt and gravel roofing, wood fibre plastering, plate glass, fire escapes, store fronts and fixtures. Work to start about June, 1914.

Stores and rooms, cost $5,000, 124th. Owner, architect and general contractor, J. A. Kruger, 10804 125th St. Two stys., 36 x 50, brick construction and foundation. Excavating done.

Warehouse, cost $75,000, 7th and Peace Ave., for Tees & Peresse, 7th St. Architects and general contractors, Fysche, McNeil, Martin & Trainer, Laugheed Bldg., Calgary. 1st, 5th and 6th floors to be occupied by Owners for wholesale house purposes; 4th floor by Wilson Ltd., wholesalers; basement, by Plunkett & Savage, wholesale fruit dealers. Six storeys.

Gannanoque, Ont.

Rebuilding factory for the Spring & Axle Co., King and Pine Sts. General contractors, Anglins Ltd., 65 Victoria St., Montreal.

Halifax, N.S.

Store, cost $6,000, Argyle St., for I. E. Sanford, Cor. Argyle and Sackville Sts. General contractors, mason and carpenter, W. T. Harris & Son, 190 Maynard St. Two storeys, 33 x 60, cement foundation, red brick construction, felt and gravel roofing.

Hamilton, Ont.

Two stores, cost $5,000, Ottawa St., for H. Grierson, 164 King St. E. General contractor, F. G. Cameron, 16 Norway Ave. Two storeys, brick construction, brick and concrete foundation, felt and gravel roofing. Excavating done.

Montreal, Que.

Store and flats, cost $40,000, Sherbrooke W., for Thos. Coggins, 319 St. Antoine St. Architect, Chas. E. Mitchell, 11 Beaver Hall Hill. General contractors, Jas. Adam & Co., 745 St. Catherine W. Plans were changed and building made larger. Contracts roofing and plastering to be given next week.

Factory alterations, cost $30,000, Fortification and St. George, for Royal Trust Co., for Montreal Star, St. James St. Architects, Ross & MacDonald, 1 Belmont. General contractors, Jas. Shearer Co., 225 St. Patrick. One storey, 32 x 144, felt and gravel roofing.

New Hamburg, Ont.

Addition to factory, cost $15,000, for The Silversmiths Co., Ltd. General contractor, Alex. Fraser. Concrete block construction, concrete and stone foundation.

Prince Albert, Sask.

Offices, cost $40,000, Central Ave. Owners, architects and general contractors, Craag & Co. Three storeys, 50 x 100, concrete, brick, stone and waterproof foundation, artificial stone, reinforced concrete fireproof and steel construction, electric lighting, steam heating, temperature regulators, fireproof floors, metal ceilings, ornamental plastering, terrazzo tile.

Quebec, Que.

Addition to store, cost $4,500, for E. A. Antil, 51 Buade St., Que. Architect, R. P. Lemay, 21 d'Aguillon. General contractors, mason and plastering, J. B. Verret & Son, 190 3rd Ave., Limoilou. Other trades not yet awarded. Two storeys, 46 x 22, stone foundation, red brick construction, steel beams. Excavating done.

Regina, Sask.

Garbage transfer station, cost $15,000, planned by City Council. M. H. O., Dr. M. R. Bow. Architect, R. W. Allen, City Engineer's Office. General contractor, J. G. Traub, Dominion Trust Bldg. 2½-storeys, brick and reinforced concrete construction. Foundations in.

St. John, N.B.

Remodelling laundry building, Waterloo, for Ungars Laundry Ltd. Manager, A. K. Mundee, 28 Waterloo St. Architect, Garnet Wilson, 50 Princess Street. Work being done by day labor.

Bank building for Royal Bank of Canada. Manager, J. B. Blair, King W. Architect, K. G. Rea, 54a Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke St. Steel work started.

Bank for Bank of British North America. Architect, G. E. Fairweather, 84 Germain St. General contractors, B. Mooney & Sons, 112 Queen St. Walls started.

South Edmonton, Alta.

Store, cost $10,000, Whyte Ave. Owner, architect and general contractor, Jno. Irving, 463 2nd Ave. S. W. Two storeys, 66 x 66, concrete foundation, brick construction, felt and gravel roofing. Excavating started.

Swift Current, Sask.

Warehouse for Moose Grocery. General contractors, Western Constr. Co., 11th Ave. Walls up.

Toronto, Ont.

Bank and offices, cost $15,000, 130-2 Church, for Bank of Nova Scotia, Melinda St. Architects, Sharp & Brown, 18 Wellington W. General contractors, Harris & Harris, Confederation Life Bldg. Mason, J. McLeod, care general contractor. Steel, Reid & Brown, Esplanade St. Two storeys, 40 r 52, brick and steel construction, concrete foundation. Foundations in.

Factory addition, cost $25,000, for Can. Rogers Co., 570 King St. W. Architect, Company's Engineer. General contractor, W. J. Trimble, Peterkin Bldg. Brick and steel construction, stone foundation, felt and gravel roofing. Work started.

Warehouse, cost $60,000, Church & Lombard, for H. M. Stevenson, Richmond E. Architect, J. W. Gray, Confederation Life Bldg. Day labor under supervision of architect. Five storeys, brick and mill construction.

Addition to factory, cost $25,000, for C. J. W. Lowes, 90 Sherbourne St. General contractor and carpenter, R. G. Kirby, 539 Yonge St. Mason, Chalkley & Son, 34 Victoria St. Owner will let plastering, painting, heating, plumbing and electrical. Six storeys, 60 x 48, brick construction and foundation.

Warehouse, Pape and Gerrard, for Geo. Gale & Sons, 323 Notre Dame W., Montreal. General contractor, T. Essery, 4 Chicora Ave. Mason, Dancy & Son, Mail Bldg. Heating, Sheldons Ltd., Kent Bldg. Plumbing, T. G. Barrington, 1000 College St.

Factory, cost $6,000, Eastern, for W. Harland & Son, 400 Eastern Ave. General contractors, Wm. Hughes & Co., 216 Simcoe St. Two storeys, 21 x 38, brick and steel construction, brick foundation, felt and gravel roofing.

Six stores and apartments, cost $25,000, College and Sheridan. Owners and general contractors, Roberts Bros., 228 Dovercourt Rd. Owners buy all material and superintending construction. Trimming 2 stores and excavating 2 stores. Brick construction and foundation, felt and gravel roofing, galvanized iron, store fronts.

Garage and stable, cost $5,000, Aylmer Ave. Owners and general contractors, Britnell Contracting Co., 209 Davenport Rd. Architect, Neil G. Beggs, 12 Cosgrave Bldg. Tenders received by Architect. Two storeys, 44 x 80, brick construction and foundation.

Walkerton, Ont.

Foundry and repair shop, cost $5,000, Station Road. Owners, architects and general contractors, Ellenhauser Bros. One storey, 40 x 50, white brick construction, patent roofing, concrete floors, high pressure piping. Walls started.

Winnipeg, Man.

Stores and rooms, cost $3,000, Broadway. Owners, architects and general contractors, Walch Land Co., Northern Crown Bank Bldg. Two storeys, frame construction, veneer brick front, concrete foundation. Excavating started.

Bank building, Portage Ave., for Quebec Bank. Architects, Brown & Vallance, 1006 McArthur Bldg. General contractors, Carter-Halls & Aldinger, Union Bank Bldg. Foundations in.

Residences

Belleville, Ont.

Residence, cost $5,000, Albert St., for Fred Quick. Two storeys, brick construction, cement foundation. Plans in progress.

Montreal, Que.

Residence, cost $23,000, for J. E. Dalrymple, 4684 Westmount Ave. Architect, A. K. Hutchison, 702 New Birks Bldg., Montreal. Concrete foundation, brick construction, felt and gravel roofing. Plans ready.

Eight flats, cost $9,000, Royer, for Jos. V. Belanger, 2005 Christopher Columbus. Three storeys, 50 x 55, concrete foundation, felt and gravel roofing. Plans ready.

Nine flats, cost $8,000, for J. P. Petel, 901 Cartier. Three storeys, 50 x 45, concrete foundation, felt and gravel roofing. Plans ready.

Two flats, cost $7,500, Chambly, for Eug. Sansregret, 86 Berri. Three stys., 35 x 38, concrete foundation, felt and gravel roofing. Plans ready.

15 flats, cost $12,000, Suzanne, for Denis Magnan, 2816 St. Dominiue. Three stys., 75 x 70, concrete foundation, felt and gravel roofing. Plans ready.

Nine flats, cost $9,000, Marie Anne, for W. D. Lambert, 1481 St. Andre. Three storeys, 24 x 40, concrete foundation, felt and gravel roofing. Plans ready.

Three flats, cost $5,500, Christopher

(Continued on page 73)

Tenders and For Sale Department

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year **1914** for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,

Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada,
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine. 42-45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension to Wharf at Callendar, Ont.," will be received at this office until 4 p.m., on **Monday, December 1, 1913**, for the construction of an Extension to Wharf at Callendar, District of Parry Sound, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Bldg., Toronto, Ont., Midland, Ont., and on application to the Postmaster at Callendar, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—49762. 45-46

Equipment Wanted

Canadian Stewart Company are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on their work in

Toronto Harbor

Communicate with

Canadian Stewart Co., Ltd.,
C. P. R. Building, Toronto.

45-48

To Contractors

Canadian Stewart Company desire proposals from experienced contractors

on

Pile Driving, Capping, Crib Work and Concrete Walls,

Ship Channel for

Toronto Harbor Contracts

Plans may be seen at our office.

Canadian Stewart Co., Ltd.,
C. P. R. Building, Toronto

45-48

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street

Proposed Government Buildings Ottawa, Ont.

Extention of Time

Notice is hereby given that the time for the reception of designs in the first competition for the erection of Departmental and Courts Buildings, is extended for three months to **Thursday, April 2nd, 1914.**

By order,

R. C. DESROCHERS,
Secretary

Department of Public Works,
—49657. Ottawa, October 23, 1913. 44 45

Sealed tenders addressed to the undersigned and endorsed "Tender for Construction of Wharfs at Victoria Harbour, B.C.," will be received at this office until 4 p.m., on **Tuesday, December 9, 1913**, for the construction of Wharfs at Victoria Harbour, **B.C.**

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' offices at New Westminster, B.C., Victoria, B.C., Confederation Life Building, Toronto, Ont., Post Office Building, Montreal, P.Q., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 27, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45197. 44-45

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf and Warehouse at Richard's Landing, Ont.," will be received at this office until 4 p.m. on **Tuesday, December 2, 1913**, for the construction of a Wharf and Warehouse at Richard's Landing, St. Joseph Island, Algoma District, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' Office, Sault Ste. Marie, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Richard's Landing, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 31, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48268. 45-46

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour and River Improvements in the Mission River, Fort William, Ont.," will be received at this office until 4 p.m., on **Friday, November 21, 1913**, for the construction of the Harbour and River Improvements.

Plans, specification and forms of contract can be seen and forms of tender obtained at this Department and at the office of W. P. Merrick, Esq., District Engineer, Fort William, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. L. Michaud, Esq., District Engineer, Post Office, Montreal, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary

Department of Public Works,
Ottawa, October 22, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46879. 44-45

Tenders for Construction of Sewer

Sealed tenders, plainly marked as to contents, will be received at the office of the undersigned up to noon of **Saturday, November 15th, 1913**, for the construction of a sewer on Bathurst St., in the Township of York.

Plans, specifications and all information may be obtained at the office of Frank Barber, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.

Toronto, Nov. 4, 1913. 45

Tenders for Rocmac Pavement

Sealed tenders, plainly marked as to contents, will be received at the office of the undersigned up to six o'clock of **Saturday, November 8th, 1913**, for the construction of Rocmac pavement on Spadina Road in the Township of York.

Plans, specifications and all information may be obtained at the office of Frank Barber, C.E., 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.

Toronto, Nov. 4th, 1913. 45

WANTED

Duplex Steam Pump, Size 17 by 10 by 12. Slight variation in dimensions not detrimental.

J. L. MILLARD,
45-46 Aylmer, Ont.

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuis, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
45-46 Woodstock, Ont.

Engineering Salesmen

Good future offered for a few clean cut Engineering Salesmen, technical graduates preferred, to act as outside representatives, for an established Consulting Engineering and Construction Corporation, based on co-operative plan. Main offices in Cleveland. Highest references and financial interest required. Contract with salary, commission and expenses guaranteed. Answer "Engineering Salesmen," c/o Contract Record, Toronto. 45

Residences

(Continued from page 71)

Columbus, for B. Sauve, 462 Colonial Ave. Three storeys, 25 x 56, concrete foundation, felt and gravel roofing. Plans ready.

12 flats, cost $13,000, St. Dominique, for D. Lamoureux & Beaudin, 1923 St. Lawrence. Three storeys, 52 x 45, concrete foundation, felt and gravel roofing. Permit issued.

Flats, cost $20,000, Blvd. Gouin, for Mr. Racine, care Architect, Z. Trudel, 238 St. Andre. Three storeys, 60 x 78, concrete foundation, brick construction. Plans drawn.

Two flats, cost $6,000, Clifton, for E. Consineau, 99 Delisle. Two storeys, 50 x 36, concrete foundation, felt and gravel roofing. Plans ready.

Flats, cost $18,000, Maisonneuve (Boubeniere St.), for P. Gadbois, 754 Adam St., Maisonneuve. Three storeys, 112 x 52, stone and concrete foundation, artificial stone, frame and brick construction, felt and gravel roofing. Plans in progress.

Eight flats, cost $9,000, Chambly, for Eug. Chaperon, 285 Stadacona. 24 x 45, concrete foundation, felt and gravel roofing. Plans ready.

Ottawa, Ont.

Apartments, cost $160,000, Metcalfe, planned. Architect, W. Herbert George, Castle Bldg., Queen St. An early start is contemplated. Six storeys; solid brick construction stone and concrete foundation.

Apartments, cost $9,000, 3rd Ave., for Jas. Hill, 68 Isabella. Stone and concrete foundation, brick veneer construction, felt and gravel roofing. Plans in progress.

Residence, cost $5,000, Willard Ave., for Oakland Land Co., c/o Mr. W. I. Spratt, Ottawa South. Brick veneer construction, stone foundation. Plans in progress.

Residence, cost $5,500, Powell. Owner and architect, W. L Brown, 133 Hopewell Ave. Brick veneer construction, stone foundation, shingle roofing. Plans in progress.

Apartments, cost $14,000, Frank, for Mrs. C. E. Hesser, 424 Lisgar. Architect, A. Tracey, Gladstone Ave. Brick veneer construction, stone and concrete foundation, felt and gravel roofing. Plans in progress.

Addition and alterations to apartments, cost $6,000, 5th Ave., for J. Moffat Ross, Metcalfe St. Architect, W. Herbert George, Castle Bldg., Queen St. Brick veneer construction. Plans in progress.

Residence, cost $10,000, Monkland. Owner and architect, W. Herbert George, Castle Bldg., Queen St. Stone foundation, solid brick construction. Plans in progress.

Quebec, Que.

Flats, cost $32,000, St. Cyrille and Cartier, for Magloire Cauchon, 309 Richardson. Architect, P. Raymond, Beauport, Que. Three storeys, concrete foundation, steel beams, frame, red and Scotch brick construction. Plans in progress.

Toronto, Ont.

One detached residence, cost $7,000, Indian Grove. Owner and general contractor, Fred Holt, 34 Victoria St. Tenders in. Contracts not awarded. 2½ storeys, 24 x 42, brick and steel construction, brick foundation, slate roofing.

Residence, cost $4,800, Bloor W., planned for Dr. W. J. Wilson, 159 College St. Tenders received by Owner. 2½ storeys, 24 x 42, brick construction and foundation.

CONTRACTS AWARDED

Edmonton, Alta.

Apartment block, cost $30,000, Bellamy St., for Wm. Stubbe, 717 Syndicate Ave. Architects and general contractors, Pietz & Schoeffel, 1063 Fraser Ave. Steel, Edmonton Iron Works, Kinistino St. Heating and plumbing, G. M. Holt, 64 Nelson St. Electrical, Installation Co., 1055 Namaya Ave. Three storeys, 41 x 80.

Residences, cost $17,500, 25th. Owner, architect and general contractor, C. R. Horne, 1700 24th St. Two storeys, 24 x 30, frame construction, concrete foundation. Expect to start work about Nov. 10th.

Montreal, Que.

15 flats, cost $15,000, Richelieu St., for J. P. Tremblay, 341 Oxford Ave. Architect, R. Charbonneau, 15 St. James St. Owner doing all work by day labor. Three storeys, 80 x 68.

Residences, cost $15,000, Outremont (Outremont), for Denis Magnan, 1816 St. Dominique St., Montreal. General contractor, A. Piche, 524 Casgrain St. Three storeys, 60 x 60, concrete foundation, brick construction, felt and gravel roofing. Excavating done.

Residences, cost $25,000, Outremont (Champagneus), for A. Villeneuve, 20 Villeneuve W. General contractor, Jos. Charbonneau, 428 7th Ave., Rosemount. Concrete foundation, brick construction, felt and gravel roofing. Excavating done.

Two residences, cost $16,000, Westmount, Belmont and Westmount Ave. Owner, architect and general contractor, Geo. E. Blackwell, 4184 St. Catherine W. Two storeys, 40 x 62, 27 x 64, concrete foundation, stone and brick construction, felt and gravel roofing. Permit issued.

Flats, cost $15,000, Delorimier. Owner and general contractor, J. A. Duval, 1701 St. Lawrence St. Architect, Z. Trudel, 238 St. Andre St. Three storeys, 25 x 90, concrete foundation and brick construction, felt and gravel roofing. Excavating done.

Three flats, cost $15,000, Draper. Owners and general contractors, Laflamme & Bidford, 296 Prudhomme. Work done by by day labor. Two storeys, 24 x 36, concrete foundation, felt and gravel roofing

Three flats, cost $16,000, St. Hubert. Owner and general contractor, L. Clement, 30 Christophe Colombe. Architect, Z. Trudel, 238 St. Andre. Work done by day labor. Three storeys, 25 x 122, stone and brick construction, felt and gravel roofing.

24 flats, cost $24,000, Westmount (Western Ave.). Owners, architects and general contractors, G. N. Clermont & Co., 97 St. James St., Montreal. Work done by day labor. Three storeys, 195 x 50, concrete foundation, stone and brick construction, felt and gravel roofing. Permit issued.

Quebec, Que.

Flats, cost $7,500, Limoilou (2nd Ave.). Owner, general contractor and carpenter, Philippe Cote, 157 Commissioners St. Other trades not yet awarded. Three storeys, 48 x 54, concrete foundation, frame and Scotch brick construction, felt and gravel roofing. Excavating done.

Regina, Sask.

Residence, cost $5,000. Owner and general contractor, D. O. Edgar, Garnet St. Two storeys, brick and frame construction, concrete foundation, shingle roofing.

Residence, cost $10,000, Rae. Owner and general contractor, Willis Rounding, Western Trust Block, c/o Rounding Land Co. 2½-storeys, brick and stone construction, brick foundation.

St. John, N.B.

Residence, cost $10,000, for Jno. Seeley, 100 Leinster St. Architect, F. Neil Brodie, 42 Princess St. General contractor, Jno. Flood, 123 Duke St. Walls up.

South Edmonton, Alta.

Apartment house, cost $18,000, 1st Ave. N. Owner and architect, Mrs. Z. Fontaine, 1st Ave. S. Work done by day labor. Three storeys, 26 x 80, frame construction, concrete foundation. Excavating done.

Toronto, Ont.

One pair residences, cost $6,000, Ashworth. Owner and general contractor, W. Prince, 17 Garnet, will receive tenders about Nov. 15th, for plastering, painting, heating, plumbing and electrical. 2½-storeys, 36 x 42, brick construction and foundation, shingle, felt and gravel roofing. Excavating done.

Apartments, cost $25,000, 1050 College St. Owner, general contractor and carpenter, Donnenfield Bros., 62 Spruce Hill Rd. Mason, T. H. Jones & Co., 314 Clinton St. General contractors will let roofing, plastering, painting, heating, plumbing and electrical. Three storeys, 48 x 62, brick and steel construction, brick and concrete foundation, felt and gravel roofing.

Four-family apartment, cost $15,000, 126 Springhurst. Owner and general contractors, W. & A. Hutchins, 167 Pearson Ave. Two storeys, 45 x 65, brick foundation and construction. Walls started.

Residence, cost $5,000, Nassau. Owner and general contractor, A. Rotstien, 55 Oxford St. Architect, J. H. Galloway, 23 Toronto St. 2½-storeys, 30 x 36, brick construction, brick foundation. Excavating done.

One detached residence, cost $15,000, Warren Road, for F. Mowat, 16 Spadina Rd. Architect, W. A. Langton, 38 North St. Mason, Orr Bros., Queen E. Carpenter, Booth & Co., 249 Davenport Rd. Balance of trades will not be awarded until about Nov. 25th. 2½-storeys, 28 x 40, reinforced concrete and brick construction, brick and concrete foundation, shingle, slate, felt and gravel roofing.

Seven pairs residences, cost $35,000, Gibson Lane. Owners and general contractors, Britnell Contracting Co., 209 Davenport Road. Architect, Neil G. Beggs, 12 Cosgrave Bldg. Tenders received by Architect. Two storeys, 40 x 48, pair, brick construction and foundation, felt and gravel roofing.

Apartment, cost $12,000, Dundas. Owner and general contractor, M. Shienkman, 405 Runnymede Rd. Architect, W. C. Mason, 358 Montrose Ave. Three stys., 40 x 60, brick and steel construction, brick foundation, felt and gravel roofing.

Westboro, Ont.

Residence, cost $5,500, Highland Ave. Owner, architect and general contractors, A. Rogers. 2½-storeys, brick veneer construction. Foundations in.

Residence, cost $5,500, Golden Ave Owner, architect and general contractor, G. F. Hinchcliffe, 39 Bayswater Ave., Ottawa. Brick veneer construction. Foundations started.

Winnipeg, Man.

Apartment building, cost $80,000, Lenore and Wolseley. Owner, heating and plumbing, L. Halpenny, 883½ Main St. Architect, D. Abramovitch, 219 McIntyre Bldg. Work done by day labor. Three storeys, steel and pressed brick construction, stone foundation, felt and gravel roofing. Excavating done.

Apartment block, cost $40,000, Lipton St. Owners and general contractors, West End Realty & Bldg. Co., Portage Ave. and St. James St. Architects, Hooper & Davis, Confed. Life Bldg. Three storeys, 40 x 86, 14 suites, stone foundation, pressed and common brick construction. Work postponed until 1914.

Two residences, cost $9,000, Lipton St. Owner, architect and general contractor, H. Haldorson, 48 Merchants Bank Bldg. Frame construction, stone foundation. Foundations in.

Apartment block, cost $65,000, Grosvenor avenue, for D. H. Bradley, care Architect, A. B. Scarlett, 797 Jessie Ave. General contractors, Winnipeg Stone Co., Elmwood. Walls up.

Power Plants, Electricity and Telephones

Burford, Ont.

Hydro power contemplated by the Village Council. By-law to be submitted in January.

Belleville, Ont.

Telephone exchange, cost $20,000, for Bell Telephone Co., H. O. Montreal. Architect, W. J. Carmichael, c/o Co., Montreal. Builders, Pounder Bros., 23 McNab St., Stratford. Three storeys, 25 x 50, brick veneer construction, cement foundation, felt and gravel roofing. Foundations in.

Forest, Ont.

Electric light plant planned by Town Council. Mayor, H. J. Pettypiece. Engineer in charge, H. A. McLean, Sarnia. General contractor, Wm. Ross, Sarnia. Contract for all electric meters and for transformers awarded to the Canadian Westinghouse Co., Hamilton.

Kingsville, Ont.

Transformer station, cost $7,000, for Edison Elec. Light Co. General contractors, The Albrecht Co., Detroit, Mich Concrete foundation, brick construction. Excavating done.

London, Ont.

Hydro Commission plan to purchase electrical apparatus, cost $20,000. Converter and other machinery to be installed for supplying hydro to companies not having direct current motors. Chairman, Philip Pocock. Engineer, H. J. Glaubitz.

Electrical apparatus required. The London Street Rly. Co. will use 800 h.p. hydro power, electrical converters and other machinery will be purchased. Manager C. B. King.

Montreal, Que.

Electrical installation in market, cost $6,103, for Town of Maisonneuve. Sec., Mr. Ecremont. General contractors, Canada Electric Co., 230 Dorchester W.

Owen Sound, Ont.

At a meeting of Council, Oct. 27th, Mayor and Clerk were authorized to sign contract for 1,200 h.p., price not to exceed $31 per h.p. Contract to run for 30 years. Power to be generated at Eugenia Falls on Beaver River. Transmission line about 30 miles. Plans to be prepared and contracts awarded during the winter.

The John Inglis Company
Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

Commission to start work of installing plant as early as possible in spring.

St. Marys, Ont.
Lighting equipment planned by Town Council (Water, Light and Heat Commission). Supt. of Commsn. Mr. Miller. Arc light system to be replaced with individual tungstens, brackets, etc., required.

St. Catharines, Ont.
Sub-station, etc., cost $116,000. By-law passed for stepping down plant and distribution system for use of hydro power. Clerk, J. A. Pay.

Winnipeg, Man.
Underground cable required by Board of Control. Engineer, J. G. Glassco, 54 King St. General contractors, Imperial Wire & Cable Co., Ltd., 902 Elec. Rlch. 5,500 ft. of No. 00 B. & S. 3 core, 2,200 volt, paper insulated, lead covered cable, $2,684.

Yorkton, Sask.
Electric power house, cost $36,000, planned by Town Council. Clerk, F. T. F. Atcheson. General contractors, Ritchie & Watters. One storey, brick construction and foundation. Foundations in.

Miscellaneous

Regina, Sask.
Lumber required by the City Council. Engineer, F. McArthur. City Commsr., L. A. Thornton. General contractors, Lumber Mfr.'s Yards Ltd., S. Railway St. For supply of lumber $9,908.40, for laying plank sidewalks, $3,296.40. General contractor, R. Flemming, 1554 Garnet St. Approximately 7 miles.

Toronto, Ont.
Tenders received until November 6th for construction and erection of 7,000 ft. of wire fence for the Humber Boulevard. Plans, etc., at Parks Department. Mayor, H. C. Hocken.

Business Notes

Brantford, Ont.
Factory and office building, Greenwich St., burned. Owned by Thornton's Ltd. (Hide, Wood and Leather Merchants). Manager, Percy S. Thornton, 120 Wellington St. Office building, two storeys, factory 1 and 1½ storeys, roof and upper parts of buildings destroyed. Loss on buildings, $6,000; contents, $60,000; insurance, $80,000. Will rebuild.

London, Ont.
Warehouse of Ontario Spring Bed & Mattress Co., 90 York St., burned. Loss to building and stock between $20,000 and $30,000.

Montreal, Que.
Wholesale house burned. Owned by the Brodeur Co., Ltd., China and Glassware, 86 St. Peter St., Montreal. Merchant, Alp. N. Brodeur. Loss $25,000.

Bakery of Jas McKeown, 370 St. Antoine St., burned. Loss $6,000.

Port Arthur, Ont.
Livery stables of Bert Graves burned, loss $5,000.

Paynton, Sask.
Factories burned, Colbourne and Wellington streets. Owners, Factory Waste & Machinery Co., Industrial Mfg. Co., Dom. Machinery Supply Co., Canada Machinery Co., Ires Modern Bedstead Co., Can. Office Furniture Co. Loss $200,000, partly covered by insurance.

Business block burned. Owned by R. Merrick, 74a Cumberland St. S. Loss $20,000, covered by insurance. To be repaired at once. Curved plate glass, store front required.

Hardware store, Cumberland St. S., owned by Fallis Foote Hardware Co., Cumberland St. S., burned. Loss $12,000, nearly covered by insurance. Store fixtures and stock required.

Winnipeg, Man.
Brewery, owned by Canada Malting Co., William Ave., and Board of Trade Bldg., Toronto, Ont., burned. Loss $100,000.

New Companies

Canadian Bitumastic Enamels Company, Ltd., has been incorporated with a capital of $40,000, to carry on business as a general contracting and building company, with head office at Toronto. The provisional directors are A. W. Holmstead, barrister, and A. B. Mortimer, law student, all of Toronto.

Niagara Brick and Tile Company, Ltd., has been incorporated with a capital of $100,000, to erect buildings and deal in uilding material, with head office at Niagara Falls. The provisional directors are F. W. Griffiths, H. F. Upper, solicitors, and W. B. Masters, real estate dealer, all of Niagara Falls.

Oshawa Central Land Company, Ltd., has been incorporated with a capital of $40,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are Russell Perkins, real estate agent, J. N. Dean, investment agent, and C. E. Johnson, bank manager, all of Toronto.

The A. M. Shaw Company, Limited, has been incorporated with a capital of $40,000, to carry on business as timber merchants, sawmill owners, etc., with head office at Fort Frances. The provisional directors are A. M. Shaw, lumberman, M. J. Noland, manager, and A. E. Carterm, merchant, all of Fort Frances.

Port Weller Land Company Limited, has been incorporated with a capital of $40,000, to carry on business as general contractors and builders, with head office at Toronto. The provisional directors are W. R. Wadsworth, D. R. Leask, barristers, of Toronto.

Clovelly Park Limited has been incorporated with a capital of $150,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are G. D. Waters, cashier, H. A. Hall, bookkeeper, and L. F. Black, accountant, all of Toronto.

Crescent Realty Company, Limited, has been incorporated with a capital of $40,000, to carry on business as builders and dealers in building material, with head office at Toronto. The provisional directors are J. J. Gray, G. H. Gray, barristers, and W. R. Willard, law student, all of Toronto.

Glen Grant, Limited, incorporated with a capital of $200,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are L. F. Black, accountant, H. A. Hall, bookkeeper, and G. D. Waters, cashier, all of Toronto.

Windsor Sand and Gravel Co., Ltd., has been incorporated with a capital of $40,000, to manufacture and deal in contractors and builders supplies, with head office at Windsor. The provisional directors are H. A. White, merchant, F. W. Barclay, bookkeeper, all of Windsor.

Toms Contracting Co., Ltd., has been incorporated with a capital of $40,000, to carry on business as brick manufacturers and dealers in all kinds of building materials, with head office at Toronto. The provisional directors are F. P. Toms, salesman, C. G. Toms, civil engineer, and A. W. Hunter, barrister, all of Toronto.

The National Forging Company, Limited, has been incorporated with a capital of $100,000, to carry on business as a general land and building company, with head office at Chatham. The provisional directors are G. H. Quennard, manufacturer, of New York, R. W. Hees and L. L. Odette, manufacturers, of Tilbury.

Hamilton Home Construction Company, Ltd., has been incorporated with a capital of $100,000, to carry on business as contractors, lumbermen, etc., with head office at Hamilton. The provisional directors are T. A. Silverthorn, F. J. Foley, barristers, and J. H. Flett, law student, all of Toronto.

The Uxbridge Foundry Company, Ltd., has been incorporated with a capital of $40,000, to carry on a general foundry, carpentry and contracting business, with head office at Toronto. The provisional directors are W. S. Thomas, broker, R. J. Christie, valuator, and W. W. Cole, accountant, all of Toronto.

Hamilton-Buffalo Real Estate Company, Ltd., has been incorporated with a capital of $200,000, to carry on business as a general land and building company, with head office at Hamilton. The provisional directors are R. L. Smith, merchant, Lewis Mitchell, manager, and F. H. Gage, builder, all of Hamilton.

Gummed Papers, Limited, have been incorporated, with a capital of $50,000, to carry on business as paper manufacturers, dealers in wood pulp, etc., with head office at Georgetown. The provisional directors are R. R. Barber, E. R. Colbert, manufacturers, of Georgetown, and G. F. McFarland, barrister, of Toronto.

General Investments, Limited, have been incorporated, with a capital of $40,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are A. H. Goodenow, D. A. Atkinson, accountants, and A. H. Moore, clerk, all of Toronto.

Geo. M. Miller & Co.

Architects

Toronto General Trust Building TORONTO

Beautiful Gas Fixtures

For the Modern Home

The fixture shown here gives some idea of the styles now being made up in gas fixtures. We had always believed that there was an undeveloped market for a very much higher grade of gas fixture than the ones usually supplied by gas companies throughout the country; and realizing too that our customers' interests were identical with our own, we set about arousing the interest of several fixture manufacturers, who have designed and made for us entirely new lines of fixtures, so that our salesroom is now equipped throughout with fixtures which, in quality of design, finish and effect, cannot, we believe, be surpassed by any lighting fixtures on the market today. Gas light is the whitest of all artificial illuminants. It is the most efficient per candle power, therefore the most economical. The use of gas in fixtures as shown here insures a display absolutely unattainable with any other illuminant. Artistic illumination is the crowning glory of the beautiful home. We have fixtures to suit every requirement and to fit every purse.

The Consumers' Gas Co.

12-14 Adelaide St. West Telephone Main 1933

Canada Lumberman & Wood Worker

Contractors' Lumber

THE most natural place to find information concerning lumber and timber is in a lumber paper.

The "Canada Lumberman" has a special department which tells of odd lots of lumber that are on the market. If you knew of them could you not often save money by buying at a reduced price instead of paying yard prices.

Published on the 1st and 15th of each month. Subscription price $2.00 a year. Sample copy free. Write us.

Canada Lumberman

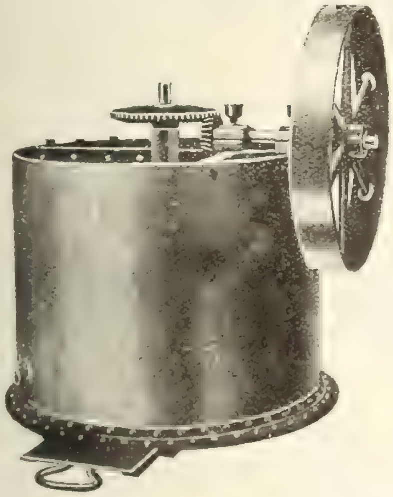
220 King St. West, - - TORONTO

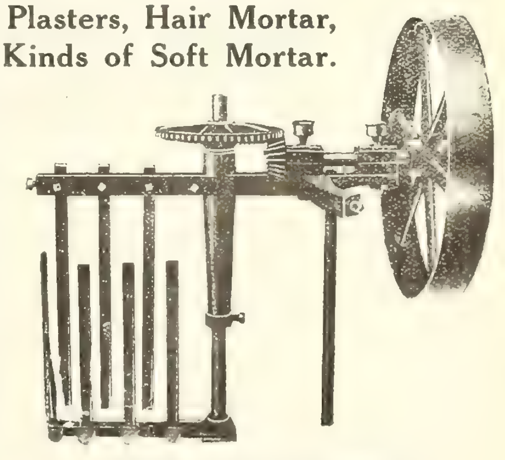
Fire One to Six Laborers on Every Mortar Mixing Job

At Last a Machine That Will Mix Patent Plasters, Hair Mortar, Wood Fibre Successfully As Well As All Kinds of Soft Mortar.

With the Harding Mixer you have efficiency in mortar mixing. Mixes a two sack batch in 3½ minutes. One man at machine can mix enough mortar to keep from 10 to 12 plasterers busy, or enough brick mortar to keep 15 to 20 masons busy. Two men at machine can keep 25 plasterers or 35 masons busy. **The Harding Mixer is absolutely guaranteed to do all we claim and to satisfy you in every way or your money refunded. The publisher of this paper will guarantee this.** Price of Mixer alone $150 f.o.b. Belleville, Ont. Price of spliced truck with two-horse engine, making complete, ready-to-mount machine, f.o.b. Iowa City, Ia., $100.

This Mixer Pays for Itself On Every Good Sized Job.





Shell Removed, showing simplicity of design.

Only a few rods. The bottom scraper keeps the bottom clean and the side scraper cleans the sides. Gate in bottom allows mortar to drop in box. It will not clog up or stall the work in any way.

A Mixing Sensation Wherever Used. ***Not a Rolling Type Machine.***

Fifteen per cent. Discount on Orders received before December 1st, 1913. For immediate or future delivery.

YOU WILL EVENTUALLY BUY—ORDER NOW AND TAKE THE DISCOUNT.

ADDRESS.

Mortar Mixing Corporation, Iowa City, Iowa, U.S.A.

Hoisting Machinery and Equipment of all kinds

Steam Hoists
Electric Hoists
Belt Driven Hoists
Horse Power Hoists

10 H. P. Reversible Builders' Hoist, supplied in seven sizes up to 50 H. P. Reversing or non-reversing.

Hand Power Hoists
and
Derrick Irons
to suit any requirements.

Steel Cars, Skips, Buckets, etc. to order.
Steel work of all kinds a specialty.

Marsh & Henthorn, Limited

BELLEVILLE, ONT.

Makers Hoisting Machinery

Sales Agents: MUSSENS, LTD., MONTREAL

Office of Dominion Iron & Steel Co., Ltd.
Built of Sydney Pressed Brick

In this product you get a brick of such superior quality that a saving of one dollar a thousand can be effected in the laying of the bricks as compared with ordinary irregular brick.

The mortar adheres with great strength to "Sydney" pressed brick and they harden with age.

Prices and Particulars on request.

Sydney Pressed Brick Co.

Limited

Sydney, Nova Scotia

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

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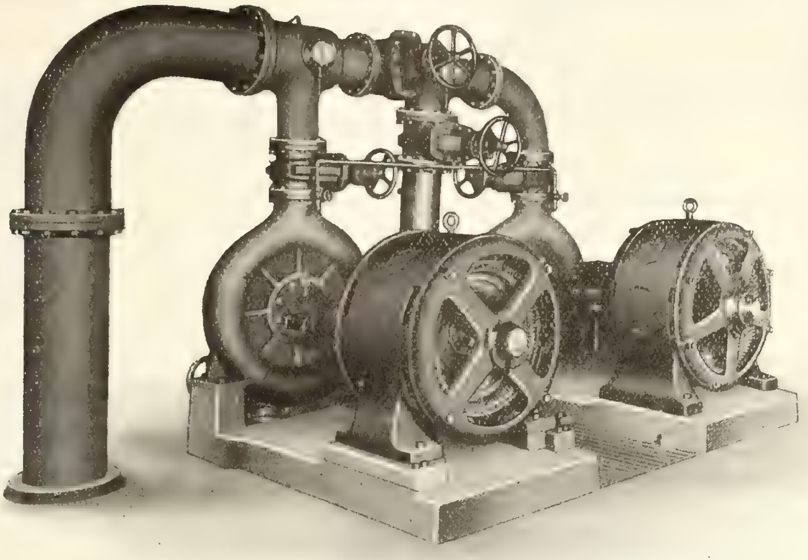
Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

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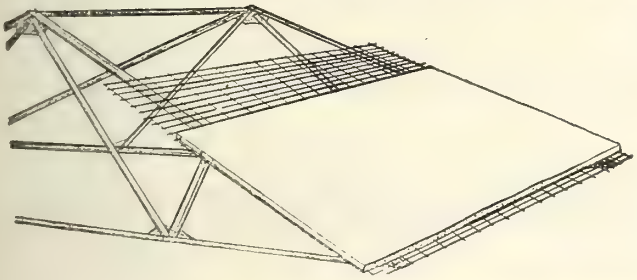
Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Concrete Reinforcement



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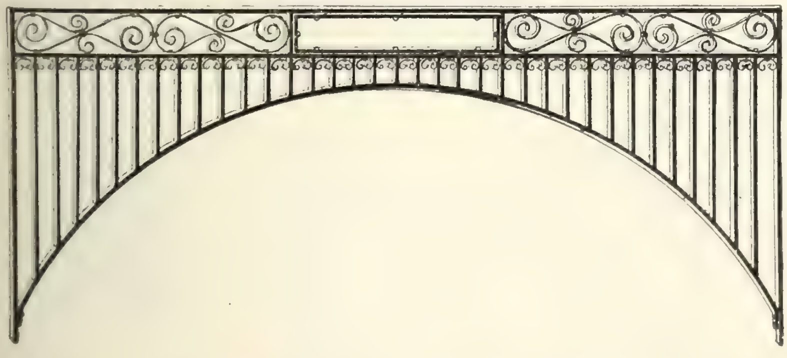
Can be made in any Length or Width to suit you.

We claim in the erection of roofs and floors our continuous reinforcement has no superior, inasmuch as it knits the entire mass into an actual monolithic slab, weak at no point and so tied together that in case of accident from any cause whatever, no single section would fall but would be sustained by carrying capacity of wires running in continuous lengths over top of roof trusses or purlins.

Enquiries solicited



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Ornamental

Wire and Iron Work

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Jail and Prison Work

Canada Wire & Iron Goods Co., Hamilton

Cap. 75000 gals. Height 85-ft.
Canadian Car and Foundry Co., Montreal

Canadian Plant

Chicago Bridge & Iron Works

BRIDGEBURG - ONTARIO

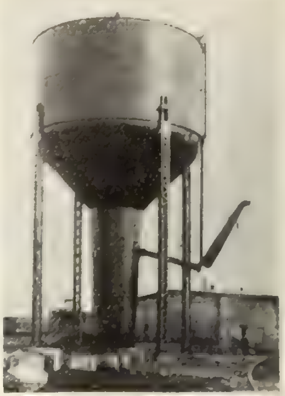
Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Buildings and Structural Material.

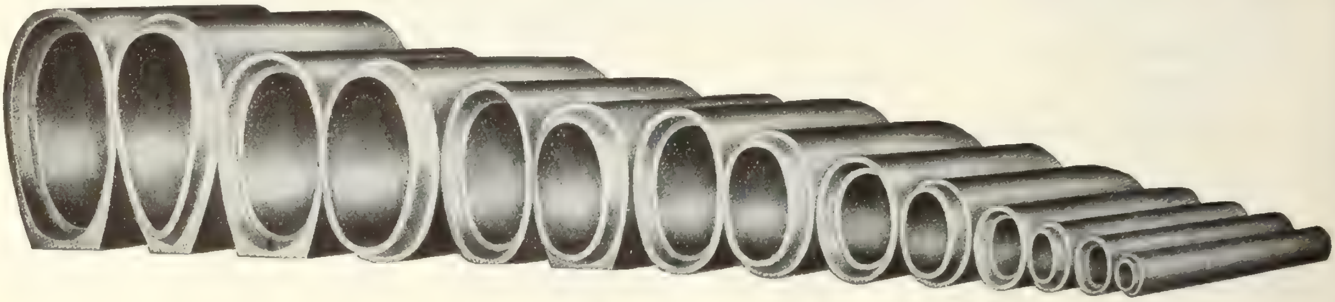
WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

OFFICES **BRIDGEBURG, ONT., CANADA**
Chicago, Ill. U,S.A.
New York, N.Y., U.S.A.
Dallas, Texas, U.S.A.
Greenville, Pa., U.S.A.

SHOPS—**BRIDGEBURG, ONT., CAN.**
Chicago, Ill., U.S.A.
Greenville, Penn., U.S.A.



Grand Trunk Pacific Ry.
Lines West of Winnipeg



Sewers and Culverts

properly built of properly made

- Reinforced Concrete Pipe -

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

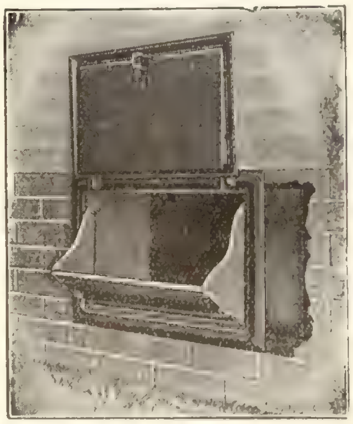
STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application.

Dominion Concrete Company Ltd.

Kemptville, Ontario



EQUIP YOUR CELLAR

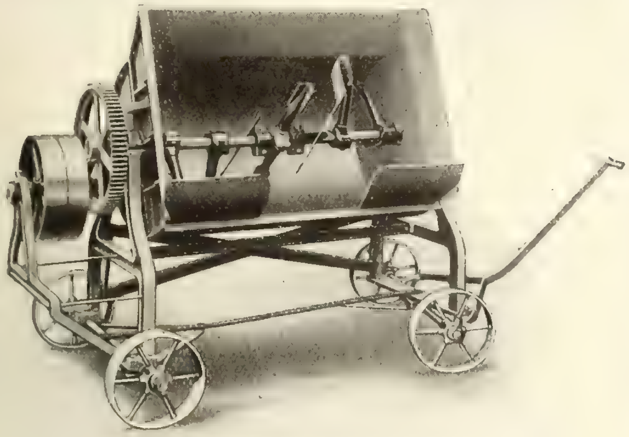
with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar.. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

Toronto Representatives: Black Building Supply Co., Mail Building
Montreal Representative: E. F. Dartnell, No. 8 Beaver Hall Square
Gorman, Clancey & Grindley, Agents, Calgary and Edmonton, Alberta

The Mixer With a Record



THE BLYSTONE HAND TRUCK MIXER

For combination shop and outside use this Hand Truck Mixer is acknowledged to be the very best on the market. It has been used on hundreds of sidewalks and foundation contracts with unqualified success. It is strongly built and so simple in design that it will never give any trouble with repairs.

Strongly Made—Well Balanced **Easy to fill—Easy to Dump**

Send for Catalogue

The Blystone Machinery Company
61 Railroad St., CAMBRIDGE SPRINGS, Pa., U.S.A.

Full line of Blystone Mixers carried in stock by

The A. R. Williams Machinery Co., Limited, Toronto, Ont.
N. J. Dinnen & Co., Limited, Winnipeg, Man.
Gorman, Clancy & Grindley, Calgary, Alberta.
Ritchie Contracting & Supply Co., Vancouver, B.C.

"Metallic"

"Eastlake" Shingles

are ideal in design for prompt and perfect work in making fireproof, lightning-proof and weather-proof roofs. "Eastlake" Shingles are the easiest and quickest-laid shingles on the market—no mechanic is needed to lay them. In use years before any other metal shingles were made in Canada.

Meet the immense and growing demand for metal shingle roofs by getting our information and selling terms to-day. The "Eastlake" long service records ensure lasting satisfaction to you and your customers.

Remember: It pays to handle the "Eastlake."

THE METALLIC ROOFING CO.
OF CANADA LIMITED,
TORONTO AND WINNIPEG

Contractors' Acetylene Flare Lights

Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

SIZE NO. 2—

1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

Price F.O.B. Ottawa $65.00.

Manufactured by

International Marine Signal Co. Limited
Ottawa, Canada

FOR SALE

1, 10 x 16 Slidevalve Engine
2, 40 H.P. Tubular Boilers
1, 10 Ton Derrick Complete
1, 30 H.P. Dick Kerr Motor
1, 40 H.P. Bullock Motor
2, 2 H.P. 2 Phase Motors
1, No. 5 Pulsometer Pump (New)
1, 1/2 Yard Milwaukee Concrete Mixer
1, 7 x 10 Blake-Marsden Crusher
1, Pair 5 Foot Edge Rolls
1, No. 3 Gates Crusher with Elevator and Screen Complete
1, 6" Morris Sand Pump Steam Connected
1, 7 x 12 Beatty Hoist with Swinger
1, No. 4 Champion Stone Crusher
1, 6 x 3 x 7 Cameron Sinker
1, Buckeye Trench Excavator

The above machines are but slightly used and are in good working order.

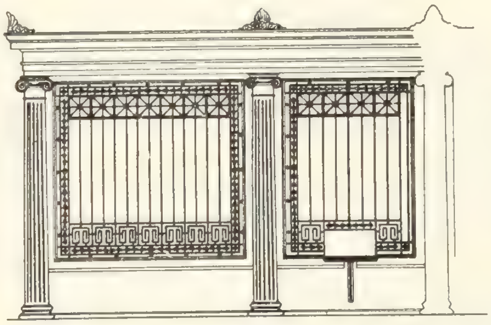
Fleming Machinery Company
340 Sparks Street, Ottawa, Can.

STANDARD FIRE-PROOF DOORS

INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

ALL OUR DOORS AND HARDWARE ARE LABELLED BY THE UNDERWRITERS.

FEATHER & ROADHOUSE **SHEET METAL WORKERS**
Phone Adelaide 2377 **528 FRONT STREET WEST, TORONTO**



Send for Section A of our new loose leaf Catalogue

Metal Work for Banks and Offices

Counter Grills Wickets
Tellers Cages, Brass Floor Railings
Door and Window Grills

We have a large, modern plating plant, enabling us to furnish all the latest electro-plated finishes.

Dennis Wire & Iron Works Co.
London, Ont. **Limited**
Toronto Branch : 36 LOMBARD STREET

Dominion Marble Company

Limited

Montreal, Que.

SOLE producers of the Beautiful Royal Dominion marble quarried at South Stukely, Que. A card or 'phone call will bring our representative to submit figures on any class of marble work. Address all letters to the Company P.O. Box 1166, Montreal.

Dietrich LIMITED

Plumbing and Heating Systems

for all types of large buildings such as factories, office buildings and warehouses.

In this connection we are prepared to undertake the design and installation of such systems, putting emphasis on the fact that by "design" we mean the correct determination of the most efficient system for the particular use under consideration.

Read those underlined words over again,—they are full of importance.

Dietrich LIMITED

300 Read Bldg.
Montreal

Dietrich LIMITED

SAND AND LIME BRICK

Absolutely the best in the city.
Daily capacity of plant: 40,000.
Uniform in size, color and quality.
Free from bats and culls.
High crushing test.

PROMPT DELIVERIES

LOOK FOR THE STOCK MARK

Telephone or write for samples and quotations.

York Sandstone Brick Co. Limited
TORONTO

OFFICE: 123 Bay St., (Stair Bldg.) Phone Adelaide 2023
WORKS: Cor. Gerrard St. and Victoria Park Ave., East Toronto Phone Beach 1505

GYPSUM HOLLOW TILE

The New Modern Method of Fireproofing

Very Light,
Easy to Install,
Holds nails, screws, etc.
Best non-conductor of heat,
Costs less than clay hollow tile,
Sound Proof.

Send for Catalogue and Price.

Alabastine Hardmortar, Ltd.
123 Bay Street, - TORONTO
Telephone M 6088

Screened Sand and Gravel

Prompt Shipment

York Sand and Gravel Co. Limited
Tel. Beach 233 East Toronto

SEE

Smyth & Ryan

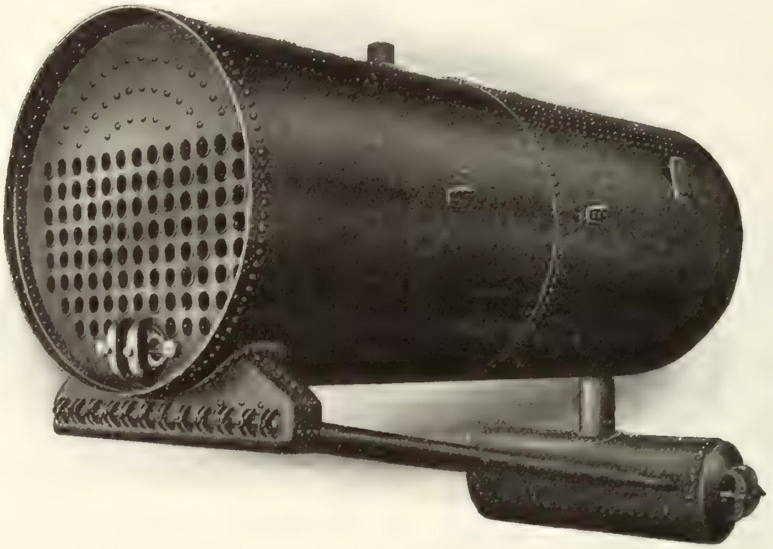
FOR QUOTATIONS ON
Lime, Stone, Cement, Sewer Pipe, Fire Brick, Weeping Tile, Mortar Colors, Plaster, &c.

Toronto Agents for
OWEN SOUND CRUSHED STONE
Deliveries—G.T.R. and C.P.R.

HEAD OFFICE, **1327 Bloor St. West**
Phones, Junct. 828 and 829
Branch Yards, 53 Merton St.
Phone, North 4751 G.T.R Belt Line
Night and Sunday calls, Phone Junction, 3333.

THE BARROW BOILER

A combination of fire and water tube construction



The Barrow Boiler

At the rear of the boiler there will be noticed a large drum, designed to take care of the mud and scale. As the water circulates down the back connection, mud and sediment will collect in the bottom of this drum and can be blown off at the engineer's convenience. The drums are so built that there are no hand holes or plugs in the fire.

The bottom of the boiler is protected from direct fire by special fire brick which fits in between and over the top of the circulating flues as far down as the bridge wall, from which point there is a pier built up on every other flue, the whole being covered with a flat tile.

The hot gases pass over the bridge wall and up between these flues to the combustion chamber, the flat tile on top protecting the underside of the boiler, then back through the boiler flues proper to the stack. The special fire brick forms a Dutch Oven, and with careful firing this boiler will consume the smoke under ordinary conditions. On account of the perfect circulation and combustion, the boiler, with normal draft, will evaporate 11 lbs. of water to 1 lb. of coal.

See Bulletin 510

CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturers of :—Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Shovels, Steam Specialties, Steam Turbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water Wheels.

Head Office : Toronto. District Sales Offices : Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

What Forty Years Experience In The Manufacture Of

Conveyor and Power Beltings

Mean To The Purchaser

Factories were few and widely scattered when we commenced to manufacture beltings over forty years ago, in a little two storey building situated on the banks of the St. Lawrence at Montreal.

The machinery in those early days, was crude and cumbersome and terribly severe on beltings, while lack of knowledge on their care and adjustment helped to aggravate belting troubles. In spite of these handicaps, our beltings "made good" from the beginning. It was evident that the principles governing their construction were right and the materials properly chosen.

Forty Years Ago The Demand For Our Beltings Was Purely Local To-Day They Are In Use All Over Canada

THESE FACTS TELL THE STORY

Our earliest efforts were directed towards the production of beltings that would overcome the severe Canadian climatic and working conditions.

Our success in this respect has never been questioned.

Every lesson that forty years belting manufacturing experience could teach, has been heeded and put to practical use. During that time, every improvement that has taken place in manufacturing machinery has been met by us and taken care of with Beltings designed to meet each special requirement.

Canadian manufacturing conditions have been studied and analyzed and nothing has been overlooked that could make our Beltings better and more worthy of your confidence.

To-day such names as **"PARA" "LUMBER KING," "STAR," "KEEWATIN"** and **"COLUMBIA"** Power Beltings and **"CANADIAN"** Conveyor Beltings are household words among those who buy beltings on sheer merit—and are made in the largest and best equipped belting plant in Canada.

We Would Like To Help You With Your Belting Troubles and TO DEMONSTRATE TO YOU WHAT OUR BELTINGS WILL DO

We know that our Beltings will give you better service than you have ever had before. We would welcome an opportunity to prove their superiority. Why not let us convince you that our Beltings possess greater TENSILE STRENGTH, GRIPPING POWER, FLEXIBILITY and SURFACE TOUGHNESS than those you are now using.

Our nearest branch will gladly give you information that will save you much money, time and trouble

WHY NOT WRITE TO-DAY

Canadian Consolidated Rubber Co., Limited

Montreal

SALES BRANCHES:

Halifax, ST. JOHN, Quebec, MONTREAL, Ottawa, TORONTO, Hamilton, London, Berlin, Brantford, North Bay,
WINNIPEG, Regina, Saskatoon, Edmonton, Calgary, VANCOUVER, Victoria

NATIONAL PIPE & FOUNDRY CO., LIMITED

WATER WORKS CONTRACTORS

MANUFACTURERS OF

WOODEN WATER PIPE

For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

WRITE FOR INFORMATION

802 McGILL BUILDING, MONTREAL Works: ALEXANDRIA, ONT.

The Maritime Bridge Company, Limited

Successors to

Wm. P. McNeil & Company, Limited

Manufacturers of

Bridges—Steel Buildings
Roof Trusses—Turntables
Towers—Girders and
Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, New Glasgow, N. S.

MR. CONTRACTOR!

Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

SAND & SUPPLIES, LIMITED

Phones: Adelaide 1947-1948

SPADINA AVE. DOCK, - TORONTO
AYR, - ONTARIO

JAMES THOMSON, President. J. G. ALLAN Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

Manufacturers

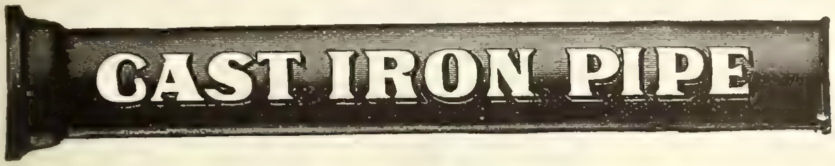
Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

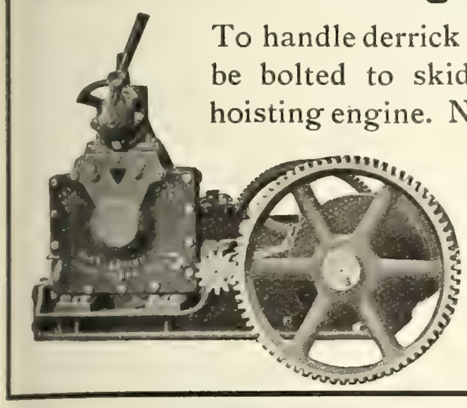
The Canada Iron Corporation, Limited



Head Office:
Mark Fisher Building
MONTREAL

Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The Dake Swinging Gear



To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

Start, Stop, Reverse at Will

WRITE FOR CATALOGUE CR.

Dake Engine Co.
Grand Haven, Mich.

When you want stone that appeals specify

"Queenston Blue" Limestone

Send us your specifications for Cut Stone work

The Queenston Quarry Co., Ltd.
ST. DAVIDS, ONT.

ROCALITE

The Ready Mixed
Hard Wall Plaster

Manufactured by

Alex. Bremner
Limited
100 Bleury Street - - MONTREAL

"Galvaduct" and "Loricated"

Conduits

for Interior Construction

Conduits Company, Limited
Sole Manufacturers under Canadian and U. S. Letters Patent
Toronto - Canada

CAWTHRA MULOCK, President - - GORDON F. PERRY, General Manager

NATIONAL IRON WORKS, Limited

LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments Offices, Works and Docks, TORONTO

CANADIAN BUILDING AND ENGINEERING REPORTS

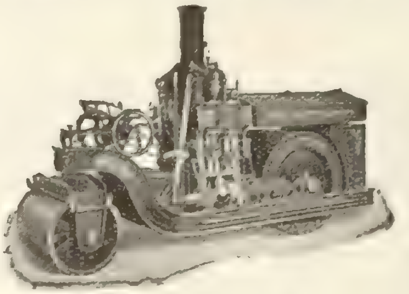
In every city in Canada our reporters keep a watchful eye on all building and engineering operations. We know every day what business is offering for firms that sell supplies, materials, furnishings, apparatus or equipment. Write us.

MacLean Daily Reports, Ltd., **220 King St. West, Toronto**

ERIE MACHINE SHOPS

P. W. DIETLY
Proprietor

Send for our Catalogue of Asphalt Rollers and Mixers.



"Our 20th Century Roller"

1303 PEACH STREET - ERIE, PA.

Residence of Ralph Peters, Esq., President, Long Island R.R.
Aymar Embury II, Architect, New York.

Shingles stained with Cabot's Shingle Stains, stucco stained with Cabot's Waterproof Cement Stains, and lined with Cabot's Quilt, for warmth.

CABOT'S CREOSOTE SHINGLE STAINS

The Standard Stains for Shingles, Siding or Trimmings. The first shingle-stain ever made, and quality guaranteed by thirty years' use. Made of the strongest and finest colors, ground in pure linseed oil, and Creosote, "the best wood preservative known," No cheapeners, no adulterations, no kerosene or benzine.

CABOT'S "QUILT"

The warmest lining. Heat-proof. Cold-proof. Sound-proof. Uninflammable, non-decaying, vermin-proof. Insulates cold-storage and ice-houses, and all other buildings. Deadens sound in floors and partitions.

Cabot's Waterproof Cement and Brick Stains

For waterproofing and tinting stucco and similar cement surfaces, and for freshening, restoring and waterproofing bricks.

Cabot's Conservo Wood Preservative

For preserving ties, poles, planking and all other lumber.

Cabot's Plasterbond Damp-proofing

For direct plastering on brick or concrete without studding or lathing. Forms a perfect permanent and impervious bond.

Cabot's Mortar Colors

Strongest, finest and most lasting.
Send for Samples and Prices.

SAMUEL CABOT, Inc., Mfg. Chemists, Boston, Mass.

Canadian Agents:

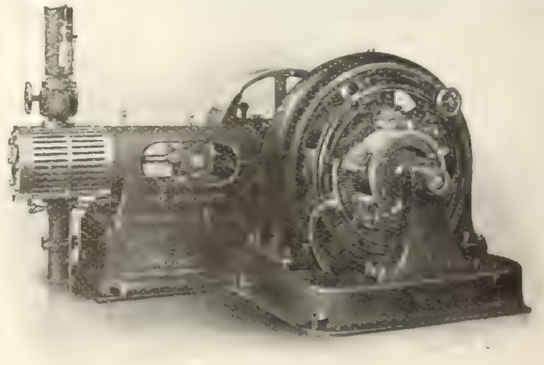
A. Muirhead Co., Toronto.
Henry Darling, Vancouver.
Saskatchewan Supply Co., Saskatoon.
Braid & McCurdy, Winnipeg..
Seymour & Co., Montreal.
Can. Equipment & Supply Co., Calgary and Edmonton.
F. A. Gillis & Company Halifax and Sydney.

McEWEN ENGINES

are sold on a basis of quality — of economical and efficient **initial** performance that is maintained year after year.

Every dollar put into the cost of your McEwen you get out in continuous satisfactory reliable service. They improve with use.

All sizes—simple and compound—up to 700 H.P. The McEwen booklet will interest you.



The Waterous Engine Works Co.
Limited

Brantford, Canada

"A MOST INGENIOUS AND USEFUL DEVICE"

—Furnishing World

Invaluable to

Piano Manufacturers
Furniture Manufacturers
Case Goods Manufacturers
Architects and Builders

Neat and Strong
Write for Booklet

SOSS INVISIBLE HINGE CO., LTD
104 Bathurst St., TORONTO

Vault Doors and Safes

J. & J. Taylor

Toronto Safe Works

Established 1855 **TORONTO**

Branches: Vancouver and Winnipeg

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

		Star	D.D.
10 to 25	united inches	$4 25	$ 6 25
26 to 40	"	4 60	6 75
41 to 50	"	5 10	7 50
51 to 60	"	5 35	8 50
61 to 70	"	5 75	9 75
71 to 80	"	6 25	11 00
81 to 85	"	7 00	12 50
86 to 90	"		15 00
91 to 95	"		17 50
96 to 100	"		20 50
101 to 105	"		24 00
106 to 110	"		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

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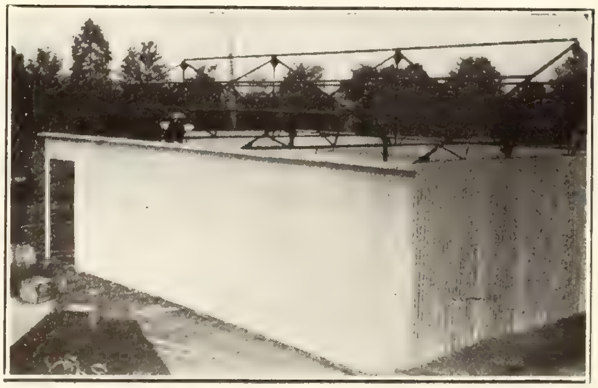

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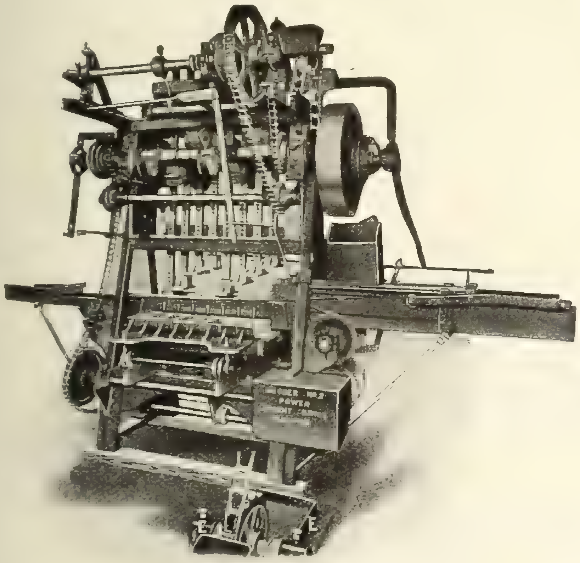

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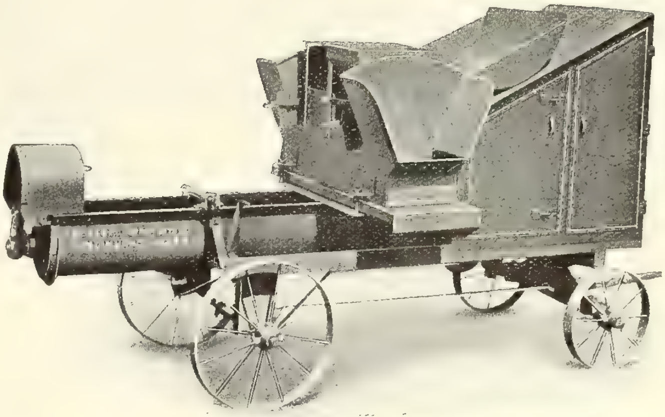

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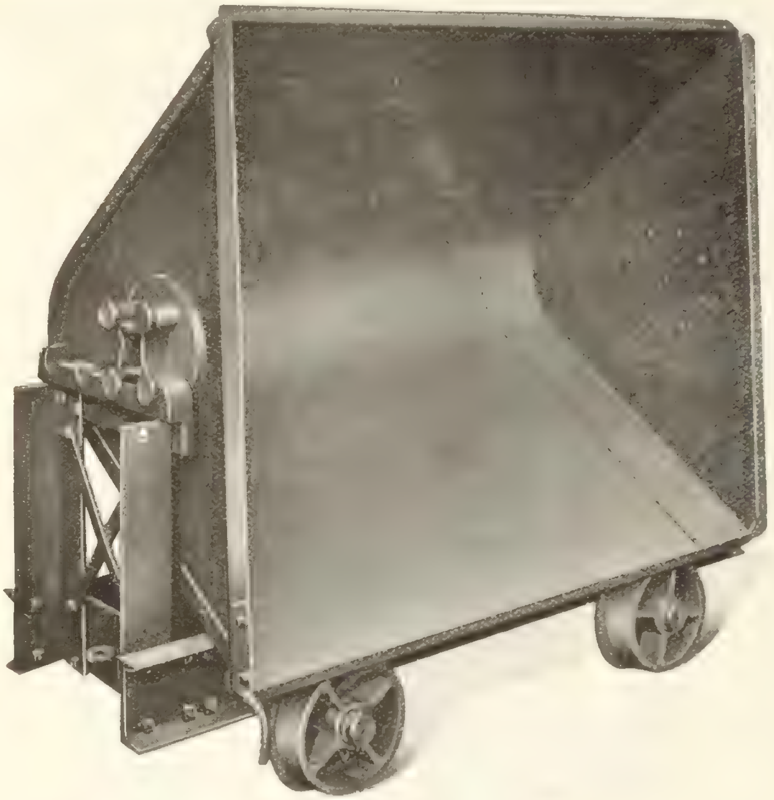

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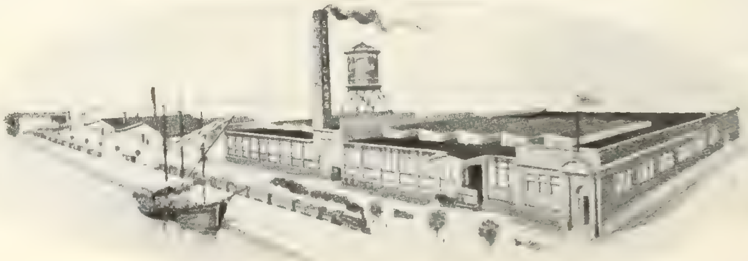

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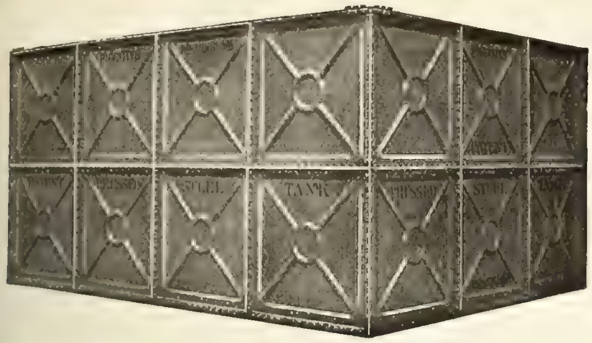

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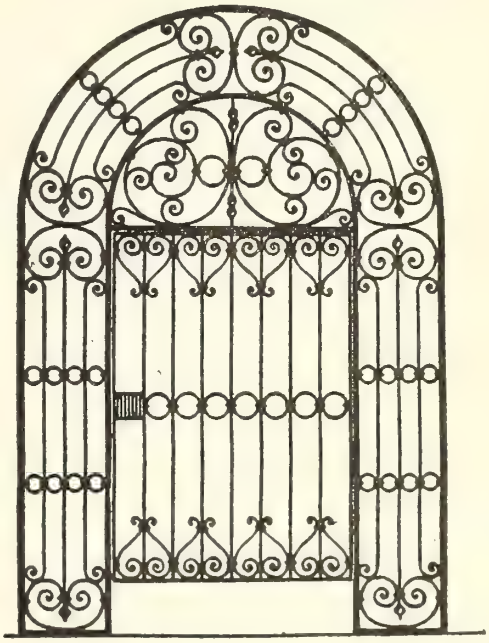

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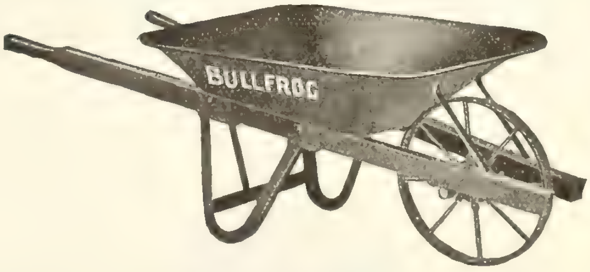

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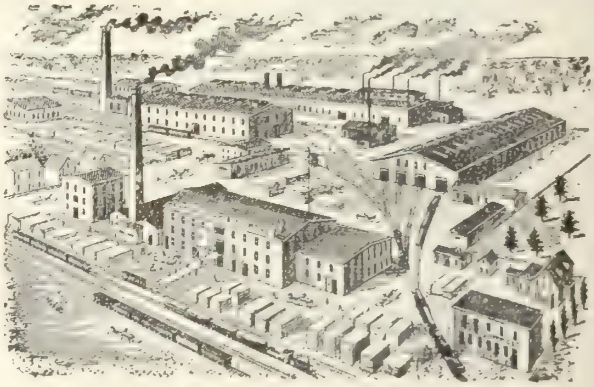

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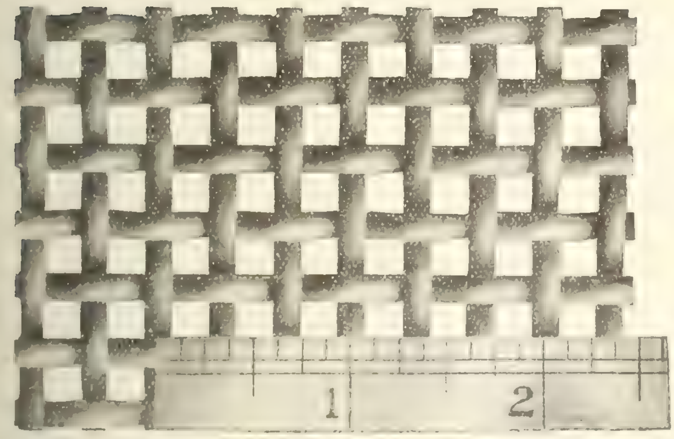

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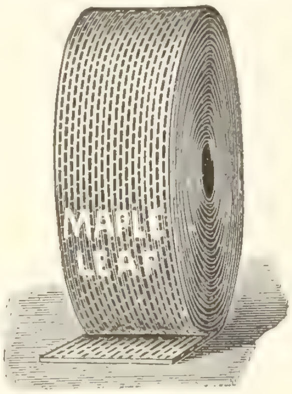

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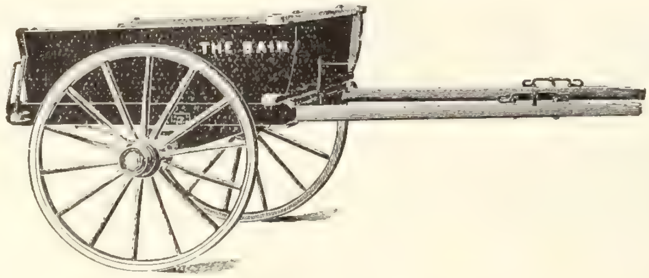
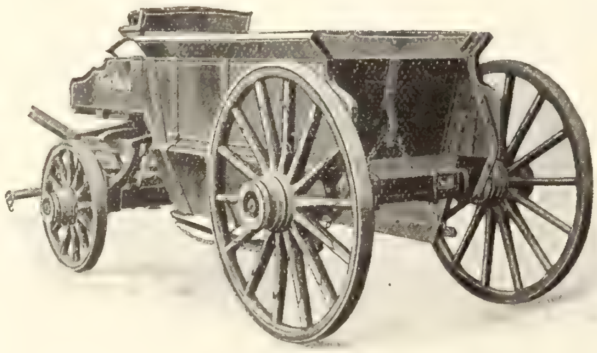


Bain Dump Cart



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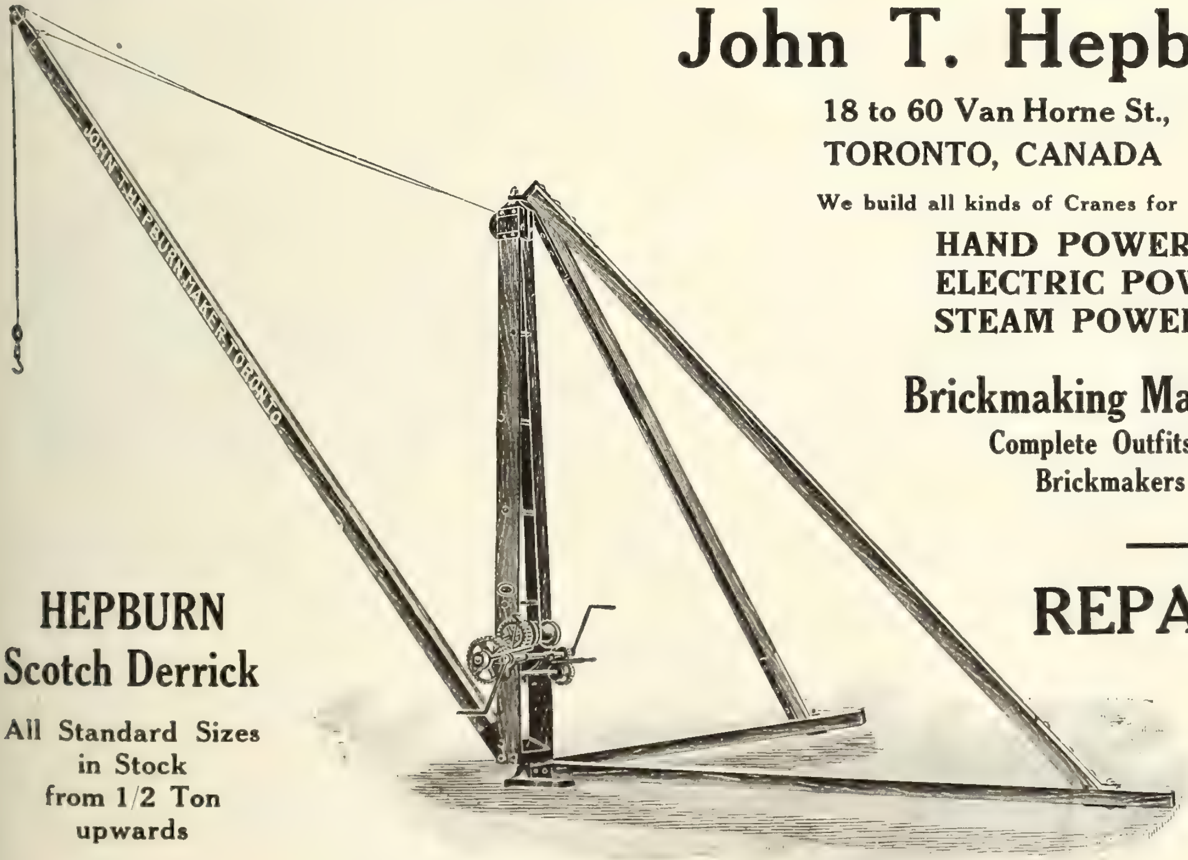
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of all designs in both iron and steel; Roofs, Telephone Poles, House Girders and all kinds of Structural Iron Work.

Our stock in hand comprises Steel Beams, Angles, Tees, Channels, Plates, Rolled Edged Flats, Bars, Rivets, Rounds, &c.; Iron Beams, Bars, Squares, Turnbuckles, Rivets, &c.

Estimates Furnished for Structural Iron Work Delivered at Building or Erected

GEORGE E. EVANS, Ontario Agency
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TORONTO
Telephone: Adelaide 2700

Post Office Address
Dominion Bridge Co., Limited
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Works at Lachine Locks, P.Q., Toronto, Ottawa and Winnipeg

The Canadian Bridge Company, Limited

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Manufacturers of

Steel Buildings Roof Trusses

Railway and Highway Bridges

Locomotive Turn Tables and Structural Steel and Iron Work of all descriptions. Estimates furnished on application.

Neptune Meter Co.

Manufacturers of the well-known

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McGregor & McIntyre

Limited
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OUR NEW WORKS: NORTH SHAW STREET

Main Structural Shop: 130 ft. x 400 ft.
Area of Grounds: Ten Acres
Capacity: 18,000 Tons Annually

We build and erect all kinds of Structural Steel Work Roof Trusses, Bank and Office Railings, Stair Work, Elevator Grilles, Fire Escapes, etc.

Over 5,000 Tons in Stock of

Beams, Column Sections, Angles, Tees, Plates, Bars, Checkered Floor Plates etc.

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Lap Welded Steel Pipe

We carry in stock
30 INCH DIAMETER
LAP WELDED STEEL PIPE

Ask for Prices

International Marine Signal Co.
Limited
Ottawa, Canada

The Des Moines Hemispherical Bottom Steel Tanks and Towers

have been used and approved by nearly all leading Engineers. They are undoubtedly the most economical means of storing water at an elevation.

We have built many of these in Canada the United States and Mexico. Estimates cheerfully furnished.

Send for Catalog No. 15

"Engineers desiring one of our Tank Calculators will receive same upon application."

Des Moines Bridge & Iron Co.
Pittsburg, Pa., U.S.A., 945 Curry Bldg.
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F. H. Hopkins & Company, Canadian Representatives, Montreal, Quebec.

Steelwork-when-you-want-it
Standard Steel Construction Co.
Limited
Welland - Canada
Manufacturers and Erectors of
Steel Buildings and Bridges

If you are intending to purchase **Steelwork** for any purpose, it will be to **your interest** to permit us to quote.

THE DOMINION WOOD PIPE COMPANY
LIMITED
NEW WESTMINSTER, B.C.
MANUFACTURERS OF
DOUBLE WIRE WOUND

AND
CAST IRON SPECIALS, VALVES, HYDRANTS, ETC.

"AMERICAN"
ENAMELED BRICK
Sanitary and Impervious

Adaptable for all kinds of building where the highest standard of brick perfection is demanded.

Write for information.

AMERICAN ENAMELED BRICK & TILE COMPANY
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Sarnia Bridge Company Limited
SARNIA - CANADA
WE ARE MANUFACTURERS OF
Structural Steel of All Kinds

Railway and Highway Bridges
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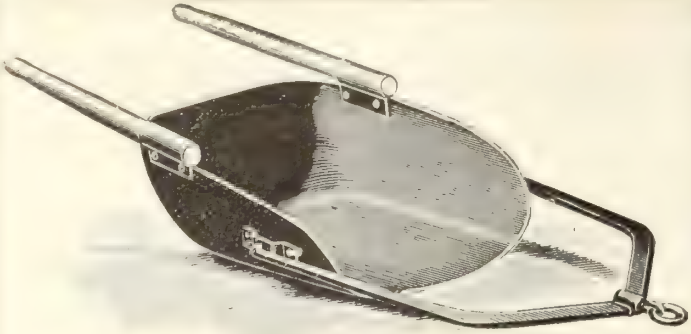
Beams, Channels, Angles, Plates
etc., in stock

ESTIMATES AND DESIGNS FURNISHED ON APPLICATION



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The Name to Buy By

CONTRACTORS' drag and wheel scrapers, steel tray barrows, pick and rooter plows, etc., are a specialty with us. The "Iron Age" Implements are noted everywhere for their efficient design and genuine good material.

When in the market for plows or scrapers write and get our particulars and literature.

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340 CAMPBELL AVE., TORONTO

BUILDERS SUPPLIES

- Lime
- Portland Cement
- White Cement
- Keenes Cement
- Plaster Paris
- Hard Wall Plaster
- Mortar Colors
- Fire Brick
- Sewer Pipe
- Weeping Tile
- Sacketts Plaster Board
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- Rubble Stone
- Crushed Stone, Etc.

With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

Ontario Lime Company
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Crown Office Building, Toronto, Ont.
Head Office Phones: Main 5472—5473

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MEXICAN ASPHALT

HERKIMER ST., HAMILTON. Paved with our Mexican Asphalt.

Write for analysis and samples

The
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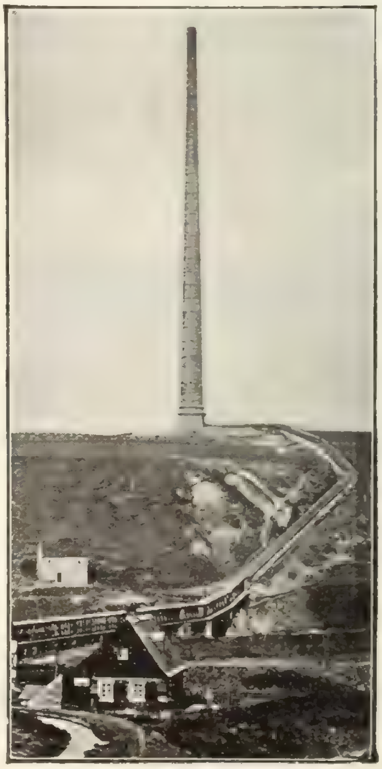
Sole Canadian Agents for the Mexican Eagle Oil Co.
Also Agents for MASTIC ASPHALT for Sidewalks.

428 Transportation Bldg., MONTREAL



460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

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Representatives for Canada:
Black Building Supply Co., Ltd. Toronto
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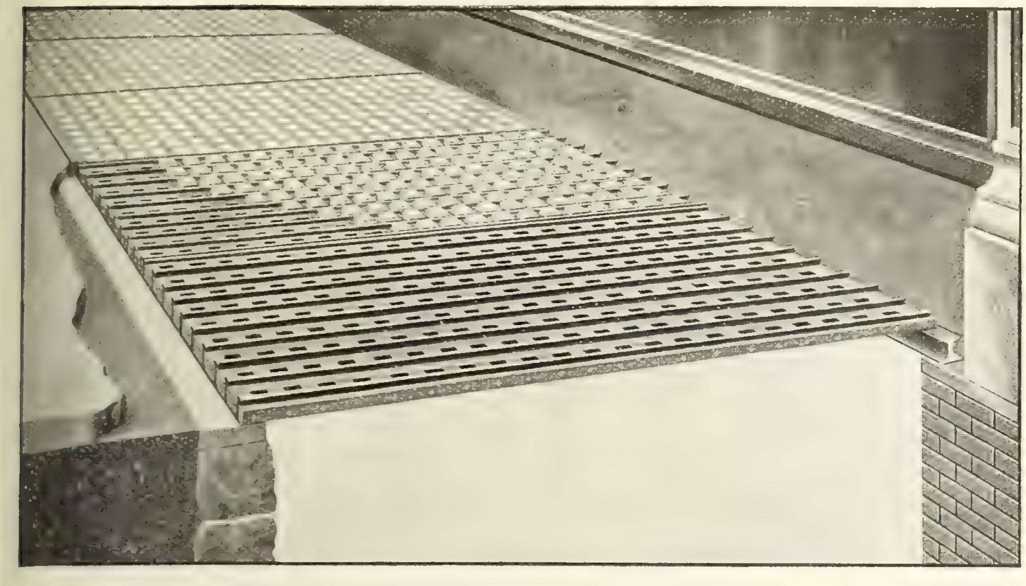
Simplex Double Reinforced Vault Light Construction



We guarantee this construction to be free from leakage and shaling of the glass.

Sole Canadian Agents and Manufacturers of

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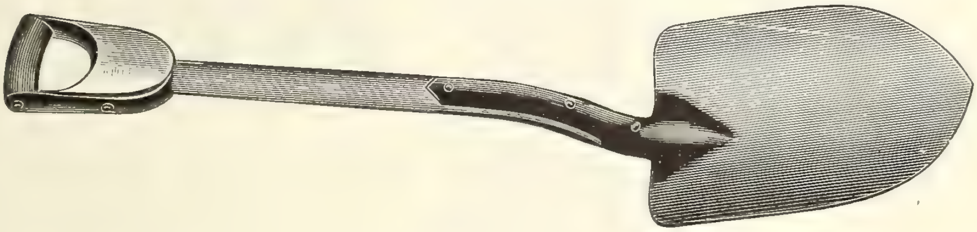
NU-PLAN
BAR LOCK
3-WAY
QUICK-SET
SIDEWALK
PRISM CONSTRUCTION

HOBBS MANUFACTURING CO., LIMITED

LONDON TORONTO MONTREAL WINNIPEG

Trade Mark



LUNDY SHOVELS

Competition is met and profitable contracting achieved by the use of up-to-date equipment in every branch of the contracting business.

When it comes to digging let your men do more efficient work by supplying them with "Lundy" or "Dandy" shovels.

They enjoy a national reputation for rigid construction and durability.

We will send to any contractor, free, express prepaid a sample shovel. Send for our illustrated catalogue showing our full line of Shovels, Spades, Scoops, Draining Tools, etc.

THE LUNDY SHOVEL & TOOL CO., LTD.

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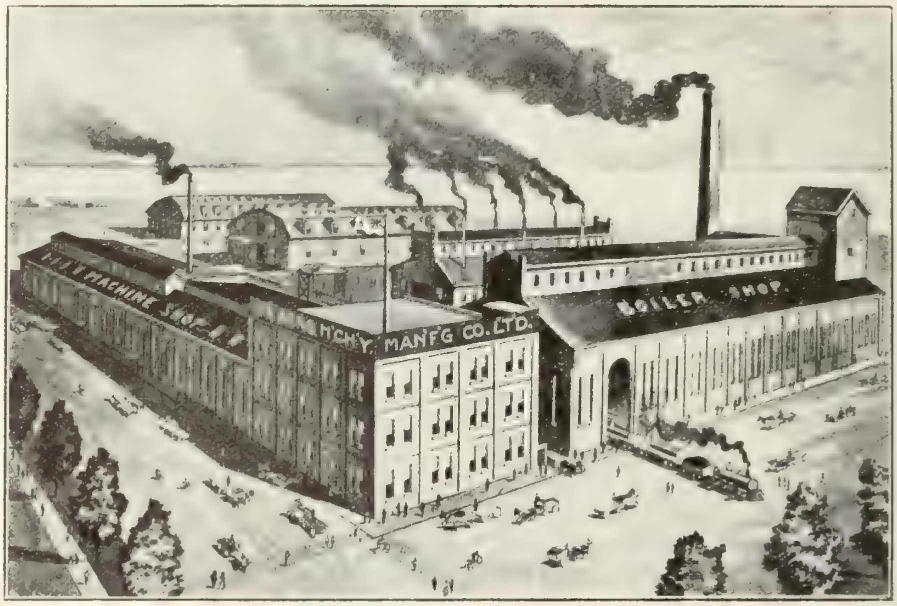
N. B. Misener, Toronto

SELLING AGENTS
Delorme Bros., Montreal; Tees & Persee, Ltd., Winnipeg
Tees & Persee of Alberta, Ltd., Calgary; E. E. Crandall, Vancouver, B.C.



The Berg Plant at Toronto

Berg Boilers

Our prices are right and our shipments prompt for every kind of boiler and plate work : : : : : : : :

Water Tubes

Horizontal Return Tubular
Fitzgibbons, Scotch Marines,
Scotch Drybacks

Steel Water Towers, Tanks and Heavy Plate Work.
Cast Iron Columns and Bases. Post Hangers

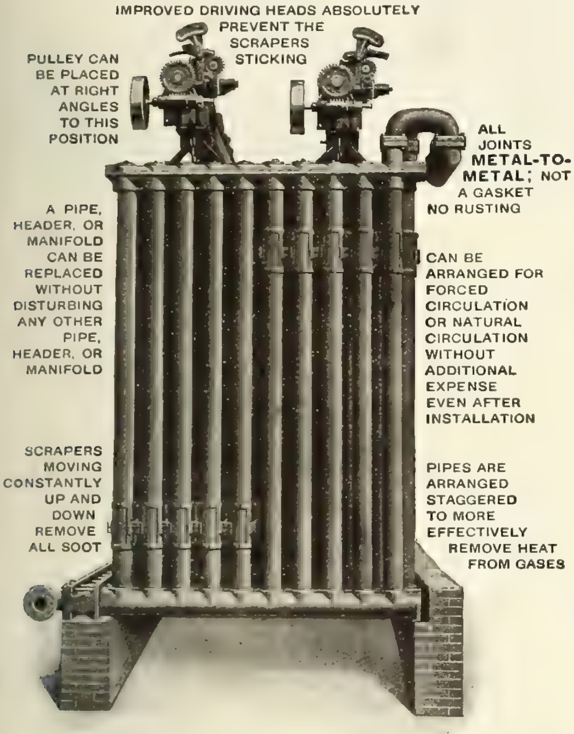
The Berg Machinery Mfg. Co., Limited

Boiler Department

Bathurst and Niagara Sts. **TORONTO, ONTARIO**

Superior Features of the Sturtevant Fuel Economizers

TRADE MARK


IMPROVED DRIVING HEADS ABSOLUTELY PREVENT THE SCRAPERS STICKING
PULLEY CAN BE PLACED AT RIGHT ANGLES TO THIS POSITION
ALL JOINTS METAL-TO-METAL; NOT A GASKET NO RUSTING
A PIPE, HEADER, OR MANIFOLD CAN BE REPLACED WITHOUT DISTURBING ANY OTHER PIPE, HEADER, OR MANIFOLD
CAN BE ARRANGED FOR FORCED CIRCULATION OR NATURAL CIRCULATION WITHOUT ADDITIONAL EXPENSE EVEN AFTER INSTALLATION
SCRAPERS MOVING CONSTANTLY UP AND DOWN REMOVE ALL SOOT
PIPES ARE ARRANGED STAGGERED TO MORE EFFECTIVELY REMOVE HEAT FROM GASES

Metal-to-Metal Joints

The taper Metal-to-Metal joints are used throughout the entire machine. They are made without rusting or packing. They do not deteriorate. They are ground to gauge and are interchangeable. Experience has proved that they are superior to gasket joints which constantly deteriorate.

Three Hundred Pounds Working Pressure

Three hundred pounds is the working pressure for which these machines are designed. They are designed for and not merely adapted to the increasing high pressures in use in modern boiler plants.

Gravity, Forced or Re-circulation

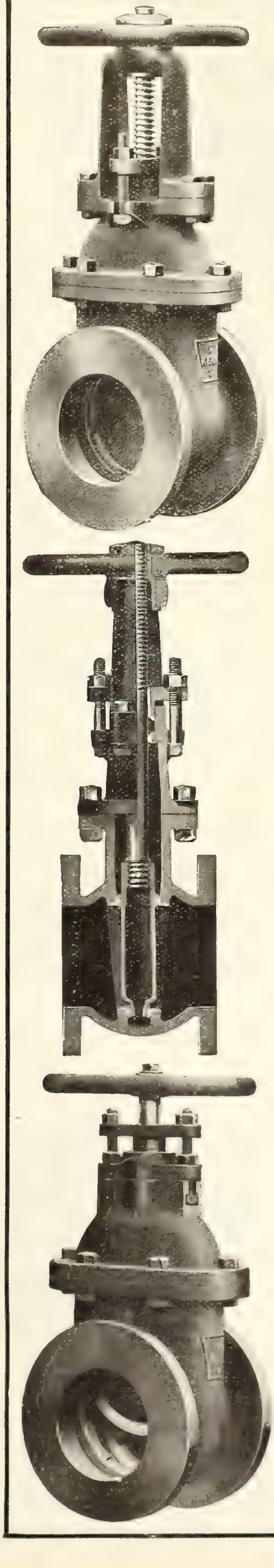
The Sturtevant Economizer is designed for either gravity or forced circulation of the water. There are many cases where the net return from the use of forced circulation will more than offset the cost of power to produce it. Our policy in making economizer contracts is to give recommendations and leave it optional with the purchasers, whether they will have gravity, forced or re-circulation.

Staggered Pipes

The "staggered" arrangement of pipes insures the most intimate contact of hot flue gases with the entire heating surface of every pipe. This, together with the flexibility of circulation makes it possible to obtain maximum results from the economizer.

Ask for Catalog 150-Z

B. F. Sturtevant Company of Canada, Limited
GALT, ONTARIO
SALES OFFICE FOR EASTERN CANADA
919 New Birks Building, Montreal



The KERR "Keystone" Iron Body GATE VALVES

are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

If you are particular about the valves you specify or buy, you will not only **specify, but demand Kerr (Keystone) Iron Body Gate Valves.**

Any **Kerr Valve** lends class and distinction to any steam or water job.

Manufactured and Guaranteed by

The
KERR
Engine Company
Limited
WALKERVILLE, ONT.

VALVES
and HYDRANTS
exclusive output.

The Permanent, Protective Building Board

LINABESTOS

Linabestos is a damp-proof, fireproof Building Board made of Asbestos and Portland Cement. It is smooth on one side and somewhat rough on the other, and is made in sheets 42″ wide, 48″ or 96″ long and 3/16 inches thick.

Though hard and semi-rigid, Linabestos can readily be worked with carpenters' tools, and nailed direct to the studding. It is either applied smooth side out and panelled with strips of wood or of the same material, or put on rough side out and covered with a thin skim coat of plaster.

Walls and ceiling of Linabestos will confine an ordinary fire to the room where it starts, and check the spread of even the worst blaze. They are sanitary, easily decorated, non-conductors of heat, practically everlasting and inexpensive.

Write for folder No. 9 giving full particulars.

Asbestos Manufacturing Company, Limited

Address; E. T. Bank Bldg. 263 St. James St., Montreal Factory at Lachine, P. Q. (near Montreal)

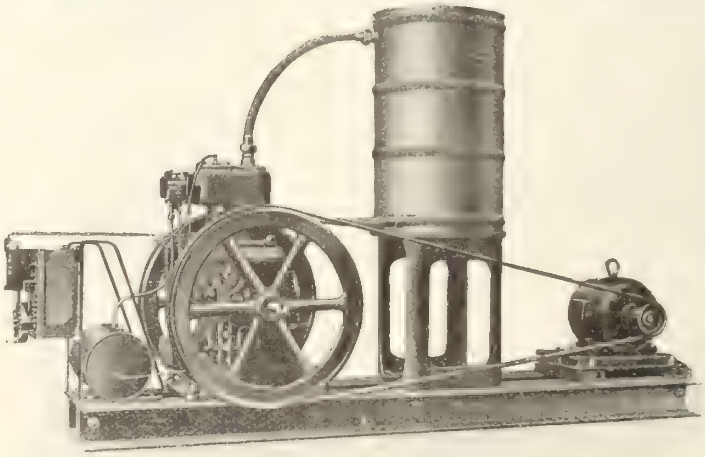
For Contractors and Municipalities

LISTER-BRUSTON

AUTOMATIC ELECTRIC LIGHTING

Suitable for Lighting

- Small Towns
- Country Houses
- Factories
- Hotels
- Clubs
- Churches
- Schools
- Hospitals
- Public Buildings



We have Supplied

Lighting Installation to municipalities and received repeat orders from them.

Requires no skilled electrician to operate.

Cheapest and easiest plant to install on the market.

It is self-starting, self-regulating and self-stopping and generates electricity at the minimum of cost.

Any voltage or capacity.

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PLANT IN OPERATION AT 190 KING STREET WEST, TORONTO

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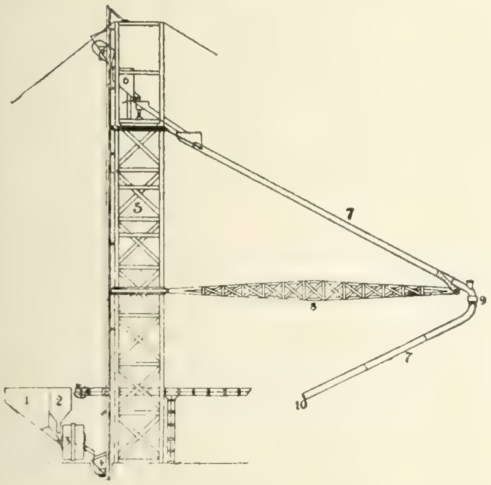
THE ONLY SYSTEM THAT HAS STOOD THE TEST OF YEARS IN THE SANITARY AND ECONOMICAL DISPOSAL OF REFUSE

DECARIE INCINERATOR CO
MINNEAPOLIS MINNESOTA



Gravity System
Distributing Concrete

A system that improves the concrete and reduces the cost.
Information gladly furnished and Estimates given on any work.

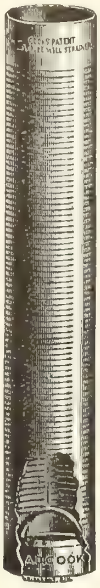
Canadian Concrete Appliance Co. Limited
Sole Licensees for Canada
613 Vancouver Block, VANCOUVER, B. C.
Eastern Representatives—
STINSON REEB BUILDERS' SUPPLY CO., LTD., MONTREAL, P.Q.

Pioneer Manufacturer of
Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.
The benefit of 20 years experience as successful contractors.

Yours for the Asking

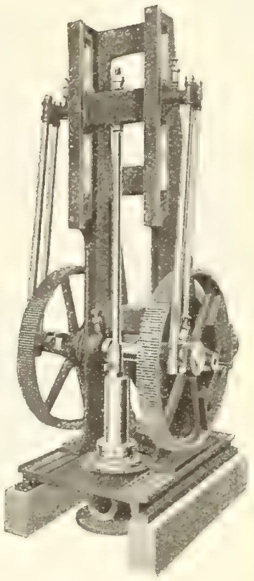
Hotchkiss Lock Metal Form Co.
BINGHAMPTON, N.Y.



Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.

Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.



A. D. COOK
Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

CATALOGUE MAILED UPON REQUEST.

Get the Best

By specifying

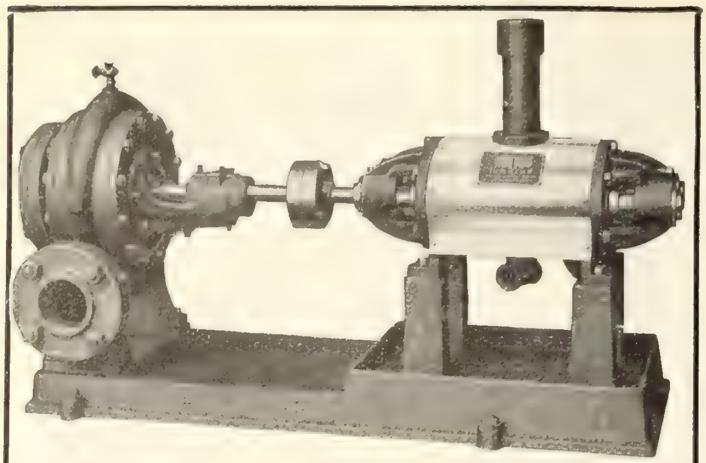
Dark Hollow Gray

Bedford Stone

From the Quarries of

The Consolidated Stone Company

General Offices, Quarries and Mills,
BEDFORD, Ind.



The new factor in Pumping Cost.

The remarkable performance of the Spiro turbine as applied to centrifugal pump drive, merely proves the old truth about the cardinal virtue of simplicity.

A gas producer yields a horsepower from the smallest quantity of coal, yet a steam operated Spiro-Centrifugal pumps a gallon of water at a much smaller total cost, figuring attendance, depreciation, investment and fuel combined.

Over and above this, the Spiro-Centrifugal has set up a new standard in continuity of operation, and by its almost total absence of repair cost.

"Buffalo" SPIRO-CENTRIFUGAL PUMPS

No one dreamed that a pair of plain herring-bone gears could be made into an engine or turbine before the advent of the Spiro. This new principle is revolutionary and has reduced prime mover construction to what would seem the limit of simplicity, service and economy combined. Not a single blade, nozzle or valve in the entire unit. Just a pair of herring-bone gears enclosed in a cylinder, with a jet of steam blown against them.

Ask for new 84-page catalog No. 225, and investigate the wonderful adaptability of the Spiro for direct connection to Pumps, Fans, Generators and machinery used in mining, quarrying and other pursuits.

Buffalo Steam Pump Co.

Sole Canadian Agents—

CANADIAN BUFFALO FORGE CO.

Montreal **Limited**

St. John **Toronto** **Winnipeg** **Vancouver**

Some recent Tuec Vacuum Cleaning contracts:

New Herald Building, Calgary ..	2	sweepers
Rex Theatre, Calgary	1	"
Mount Royal College, Calgary ..	2	"
Ogden Hotel, Calgary..	2	"
Burns and Company, Calgary ...	1	"
Johnson Building, Calgary	1	"
Grunewald Hotel, Calgary	1	"
Strathcona Hospital, Edmonton.	2	"
Saskatoon School Bd., Saskatoon.	2	"
Empire Hotel, Saskatoon	1	"
Nels Nelson, Westminster	1	"
C. P. R. Depot, Vancouver	6	"
R. H. Williams & Sons, Regina..	1	"
Ford Motor Car Co., Walkerville.	1	"
Hiram Walker & Sons, Walkerville	1	"
St. Boniface Schools, St. Boniface.	2	"
Chicoutimi Seminary, Chicoutimi,	2	machines
City Hall Annex, Montreal	5	sweepers
Shaughnessy Building, Montreal .	4	"
Sauvegarde Building, Montreal .	4	"
Royal Trust Building, Montreal.	4	"
McGill Building, Montreal	4	"
Sir Rudolphe Forget, Montreal .	1	"
C. W. Sherwood Co., Winnipeg .	3	"
Technical High School, Toronto.	8	"
Lieut.-Governor's Residence, Tor.	2	"
Jas. Ryrie of Ryrie Bros., Toronto	1	"
A. J. Gough of Sellers-Gough, Tor.	1	"
Humberside Collegiate, Toronto.	2	"
Manning Ave. School, Toronto..	2	"
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Harry Cockshutt, Brantford.. ..	1	"
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Stationary Air-Cleaning System

Canadian Factory—

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CANADIAN TUEC DISTRIBUTORS

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Tuec Co. of Winnipeg—419 Portage Ave., Winnipeg, Man.
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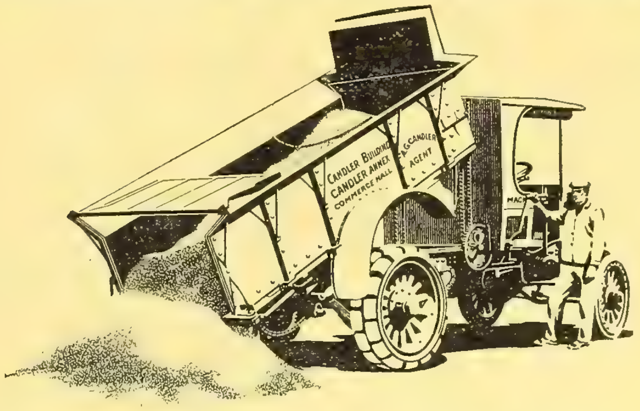
Tuec Co. of Montreal—406 New Birks Bldg., Montreal, Que.

MACK

A Mack Truck That Replaced Five Double-Teams In Winnipeg



The five-ton Mack Dumping Truck shown here is owned by the Lake Winnipeg Shipping Company, Limited, and it has replaced five double teams, the service of which teams would cost approximately $30.00 per day. This truck is engaged in hauling gravel, sand and rubble from the docks to various points throughout the city. The heavy mud which forms on the unpaved roads after rainfalls does not interfere with its operation.

We have records of hundreds of five-ton Mack Trucks that are earning from $30.00 to $50.00 per day.

Mack Trucks have proven their reliability, economy and long life by 12 years of real service in every line of transportation.

You should investigate the Mack before buying a truck. Ask us to show you.

The Canadian Fairbanks-Morse Co., Limited

St. John, N. B. Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver

9

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Fifth of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

C. P. R. Hotel, Calgary

This building was wired with
"Adanac" Rubber Insulated Wire

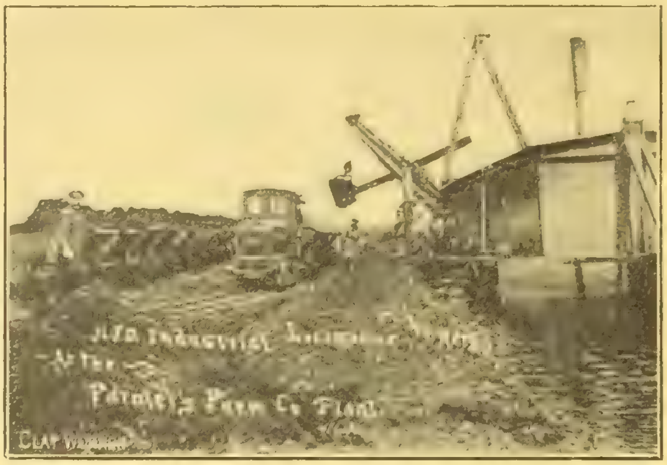
Architects and Engineers: E. & W. S. Maxwell, Montreal
Electrical Contractors: Parker-Chase Electrical Construction Company, Calgary.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd. Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"



Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

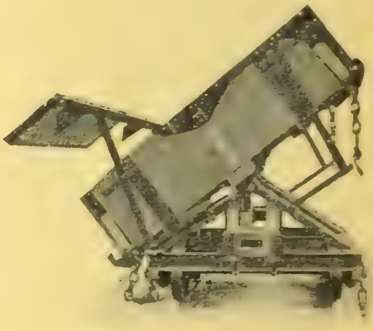
Brickyards, Quarries, Mines, Contractors, etc.

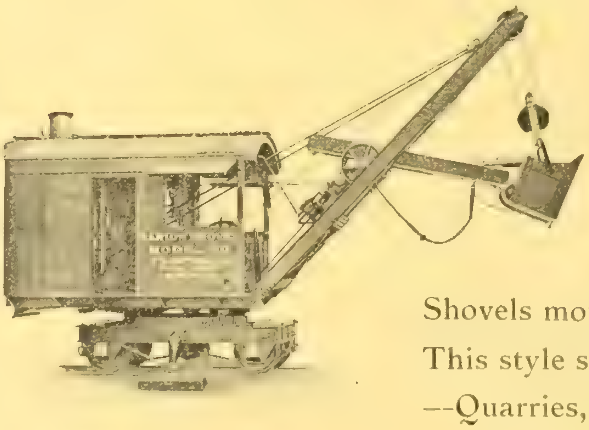
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.





"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes

5 8 - 1 and 1 1 2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

BRANCH OFFICES: General Supply Company of Canada, Ltd., Winnipeg Agents
Ritchie Contracting & Supply Company, Ltd., Vancouver Agents

Vol. 27 Toronto, November 12, 1913 No. 46

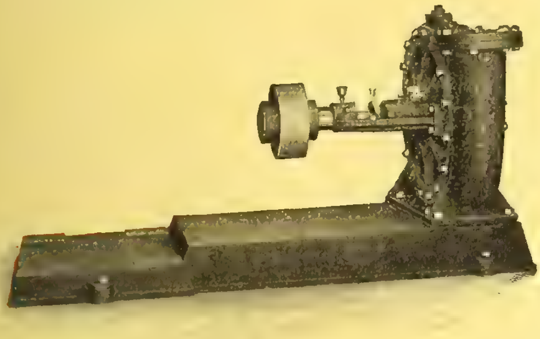
ESTABLISHED 1886

Contract Record and Engineering Review

We manufacture all kinds of

Steam and Power Pumps

for all kinds of service, using only the best material and workmanship.



THE SMART-TURNER MACHINE CO.
HAMILTON, CANADA LTD.

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

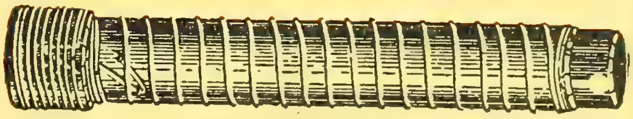
INGERSOLL-RAND

SHEET PILE DRIVERS

FOR WOOD OR STEEL
SHEET PILES

This machine is comparatively light but does the work of a much heavier type owing to the careful distribution of the weight involved.

Canadian Ingersoll-Rand Co., Limited
MONTREAL, CAN.



Continuous and Machine Banded Wood Stave

WATER PIPE

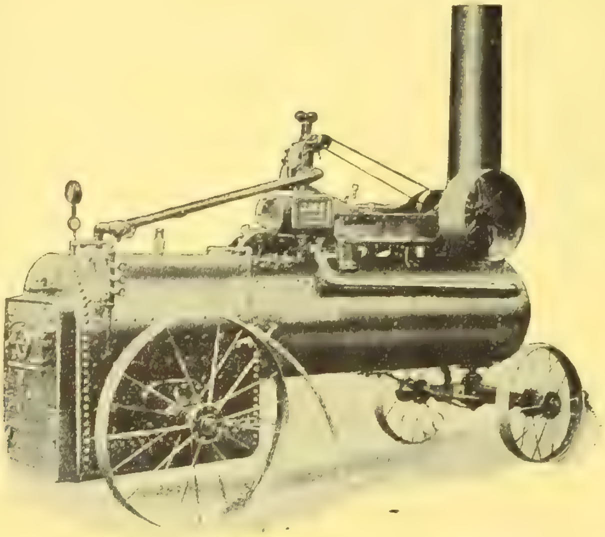
RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6

PORTABLE POWER PLANTS



THE cut shows one of our compact and *portable* power plants for driving Crusher Outfits, etc. A complete power plant in itself—durable and efficient. We build different sizes and can meet your requirements precisely.

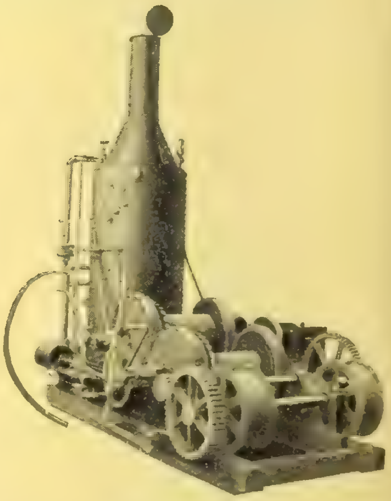
The Jenckes Machine Co.
Limited

General Offices:—Sherbrooke, Que.
Works:—Sherbrooke, Que.; St. Catharines, Ont.

Offices:—Sherbrooke, Montreal, Toronto, St. Catharines, Cobalt, South Porcupine, Nelson, Vancouver.

POWER

That's what you buy a Hoisting Engine for, isn't it?



You select an engine because you are assured that it will lift such and such a load. If it comes up to expectations you are satisfied.

***But*——**

Some day you have a job that requires a little more power—more sustained effort. The engine cannot muster the extra strength.

***Result*——**

You are put to the expense of buying a new engine of greater rated power. Now, if your first engine had been an "AMERICAN" it is practically certain that it would have handled the second job in good style.

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But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

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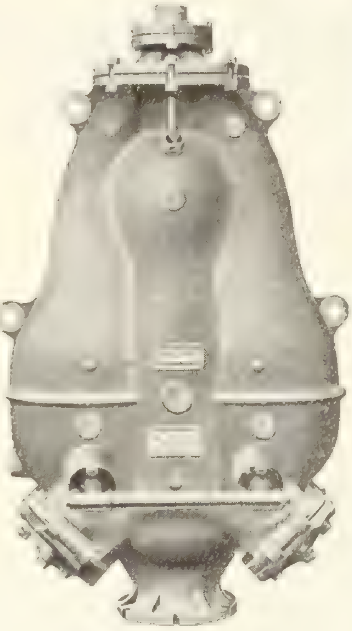

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CONTRACTORS,

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Steam,
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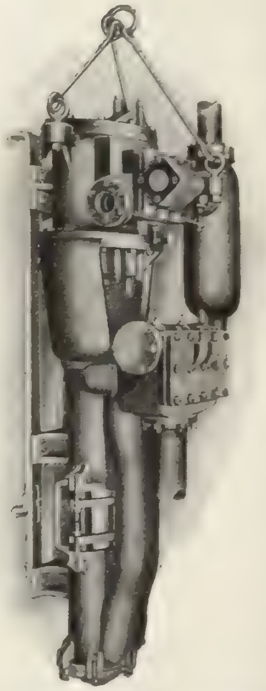

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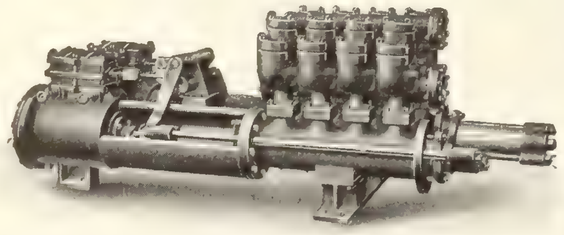

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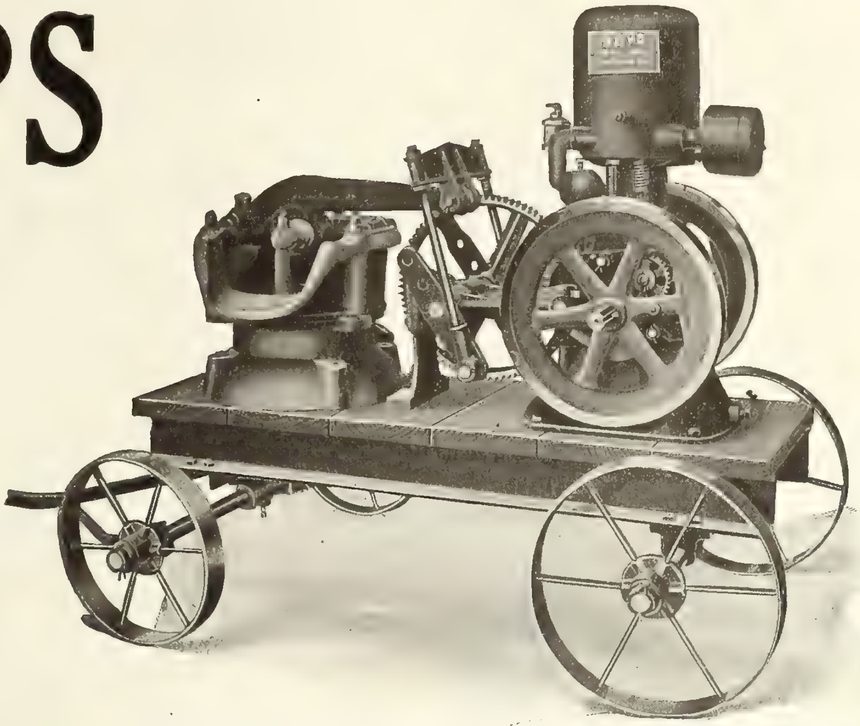

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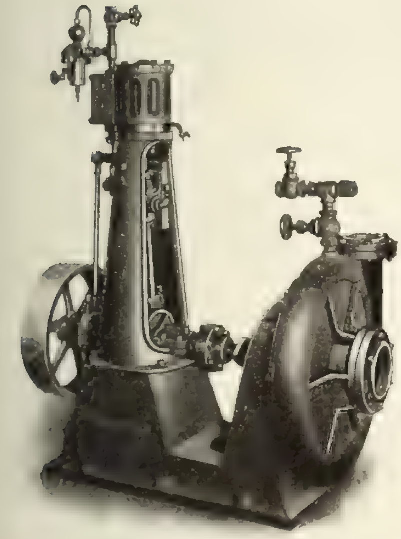

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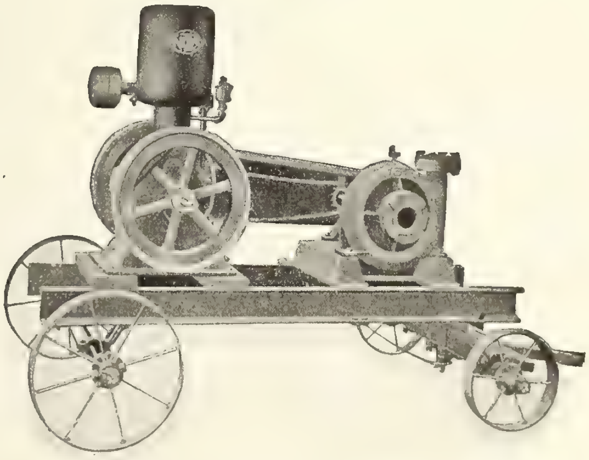

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To be
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Throughout
With
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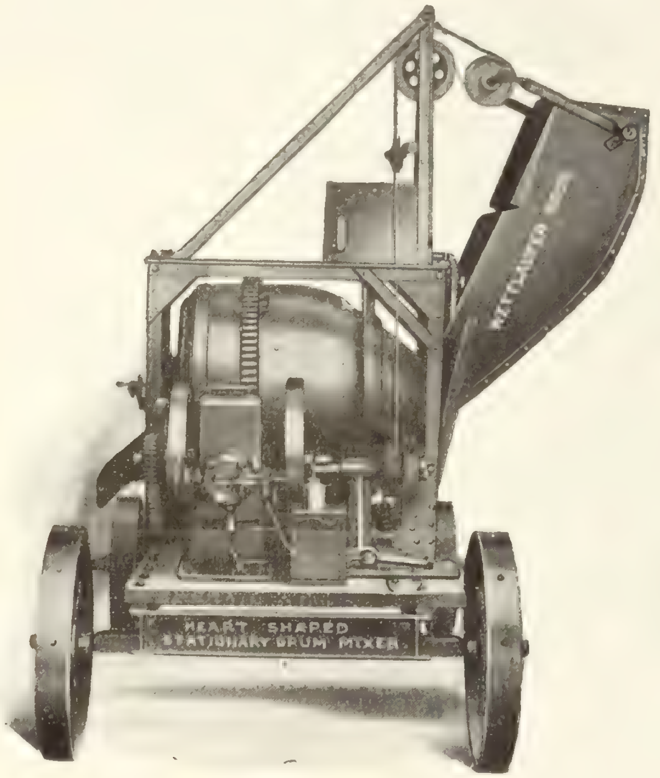

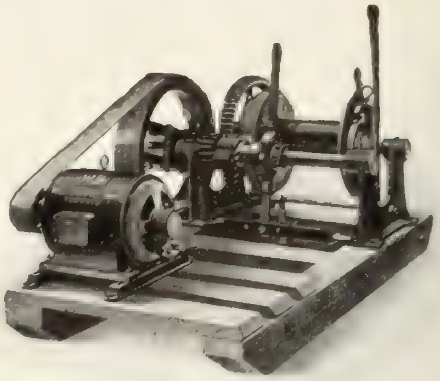

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Quarries at Dundas and Vinemount

Write or wire for quotations

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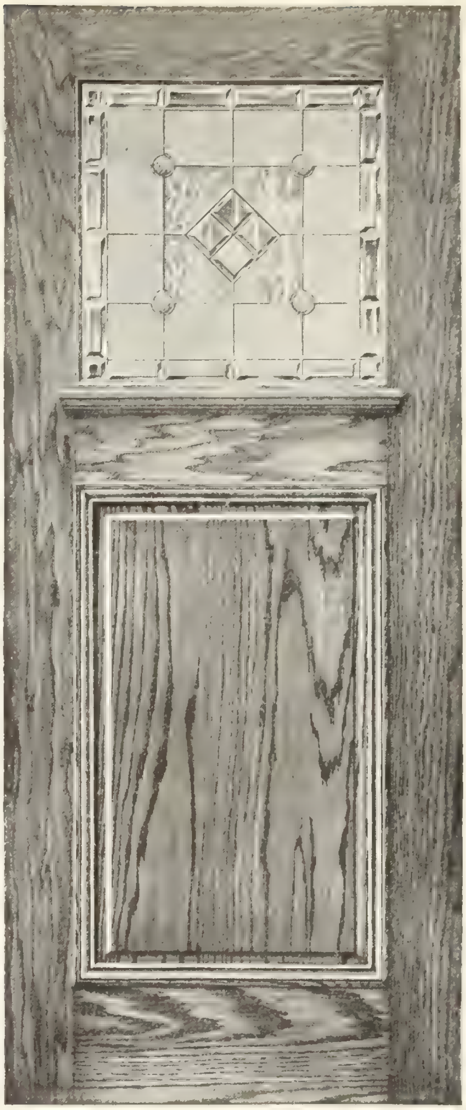
Balusters
Columns



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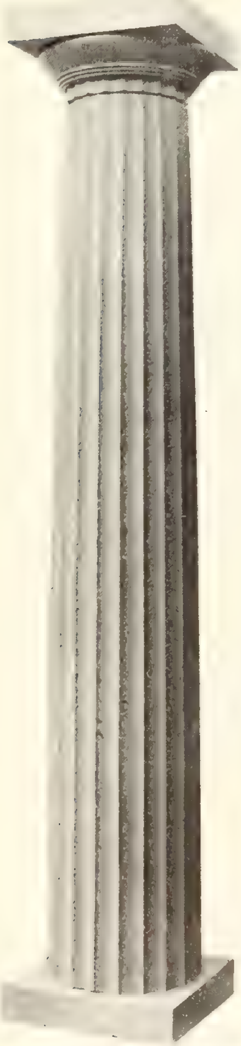

IF you want high-class doors of good appearance and made of selected woods, we suggest Batts Limited as the place to get them. The workmanship in our doors is thorough and all woods are properly seasoned giving the doors long life.

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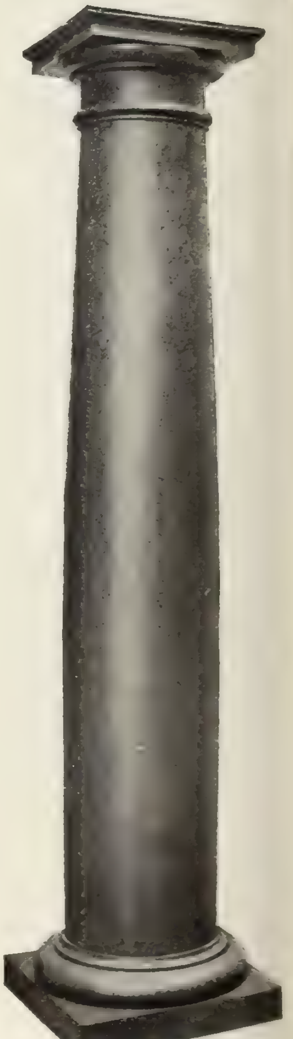
Limited
Pacific Ave., Toronto



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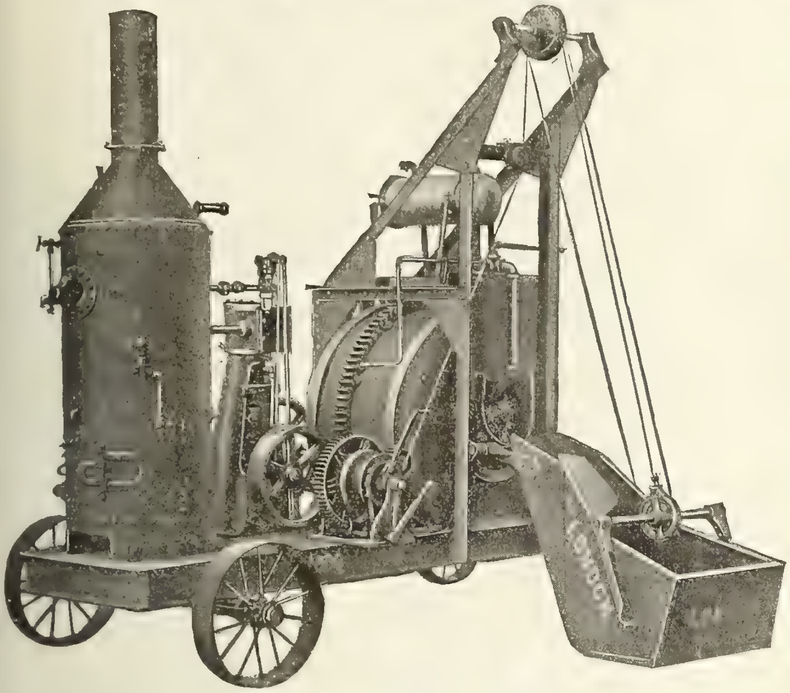

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Several Kinds, and built in sizes to suit all classes of work

The many improved features of the London Mixers have placed them in a class by themselves.

We can save the contractors money—

On First Cost
On Cost of Maintenance
On Cost of Operation

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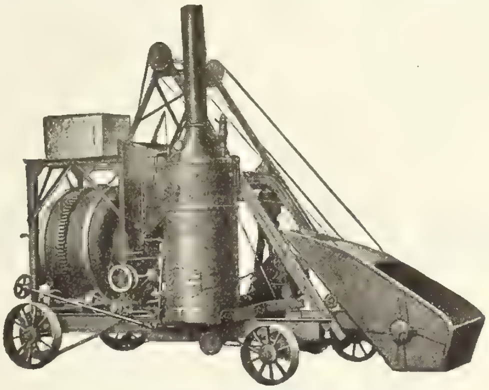
Also a full line of Hoisting Engines and Contractors' Equipment.



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Our machines are not made down to a price, but **made up to a standard.**

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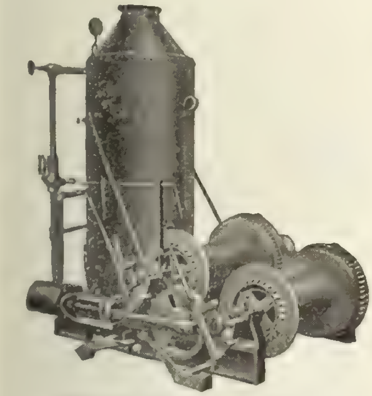

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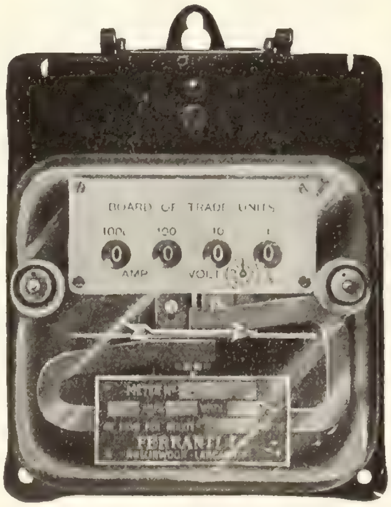

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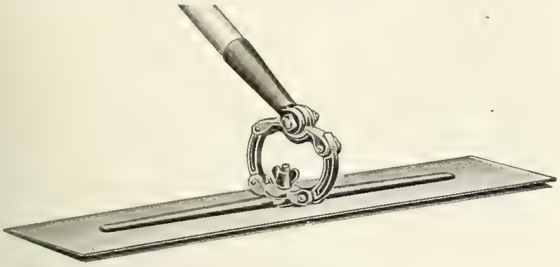

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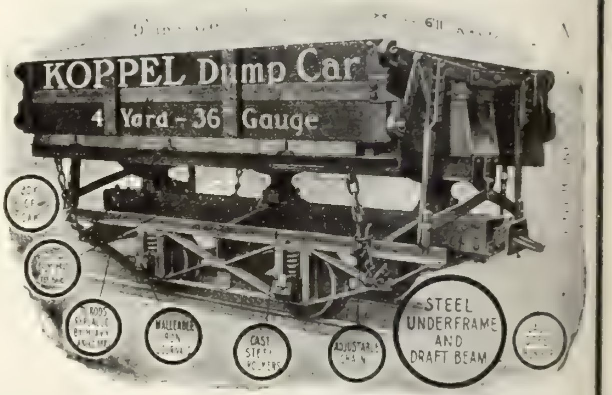
Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

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Prevents Dust~

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A New Principle In Road Building

It has long been recognized by engineers that one of the greatest causes of the destruction of macadam roads by traffic has been the internal movement caused by the passage of heavy loads. The endless shifting and creeping of the lower courses of stone causes a grinding and pulverization which destroys the stone and breaks the bond.

To reduce this internal movement engineers have buried the larger stone under successive layers of finer stone. This fine stone forms dust more rapidly but the dust serves to protect the foundation of the road by acting as a cushion. Modern traffic makes the use of such dust cushions quite impracticable, for the automobiles not only stir up the dust but create entirely new conditions by scouring the surface of the road and breaking the bond with the backward thrust of their driving wheels.

The possibility of making roads automobile-proof by using Tarvia as a binder from top to bottom of the wearing-course during the construction of the road has now been satisfactorily demonstrated. The Tarvia fills the voids and forms a tough, durable matrix in which the stone cannot shift or grind. Consequently it has become possible to use large stone in a much greater proportion to the construction. The fine screenings and stone chips are used only on the surface as a finishing coat.

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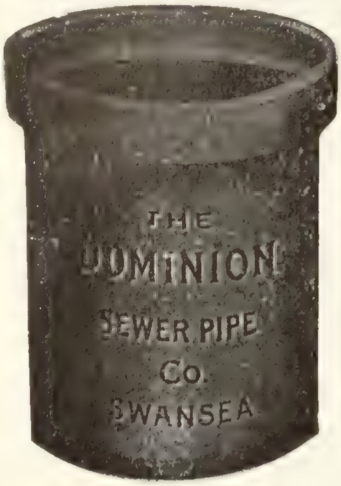

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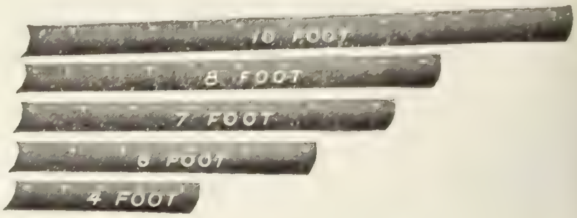

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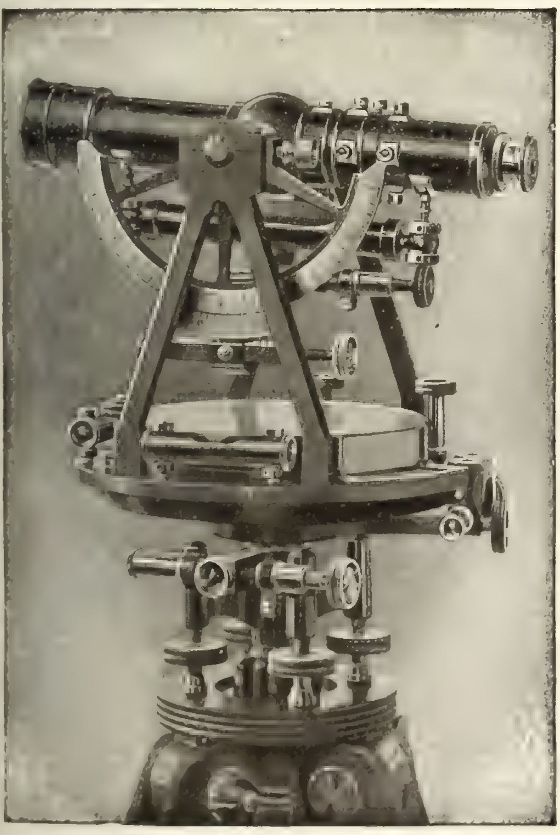

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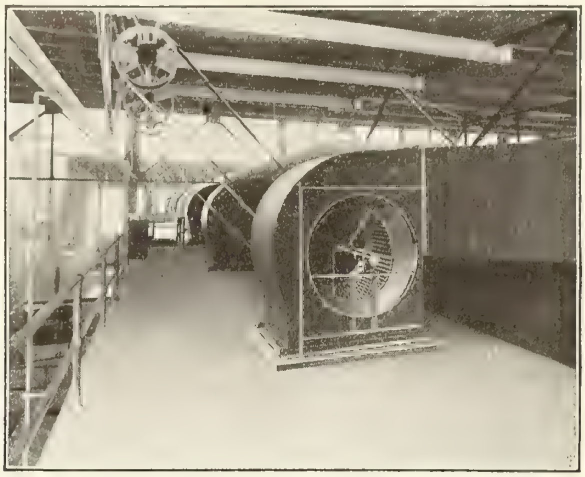

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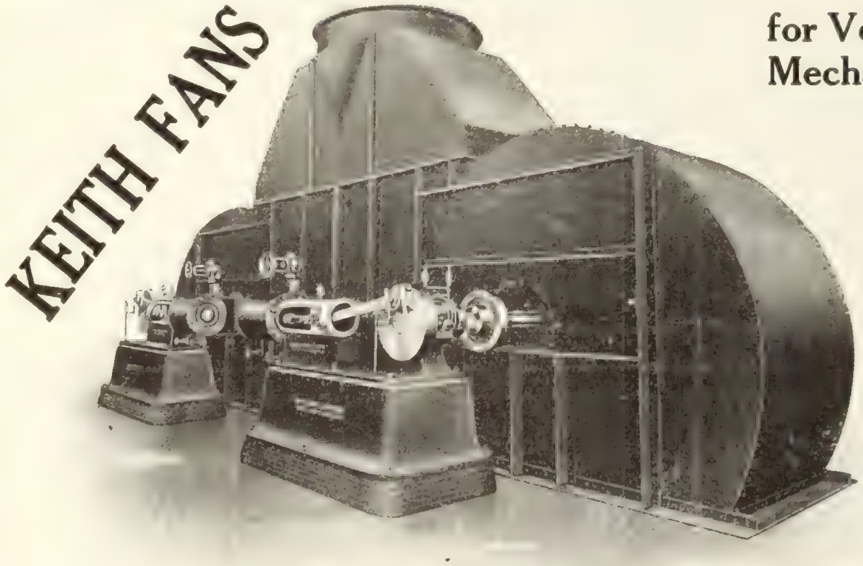

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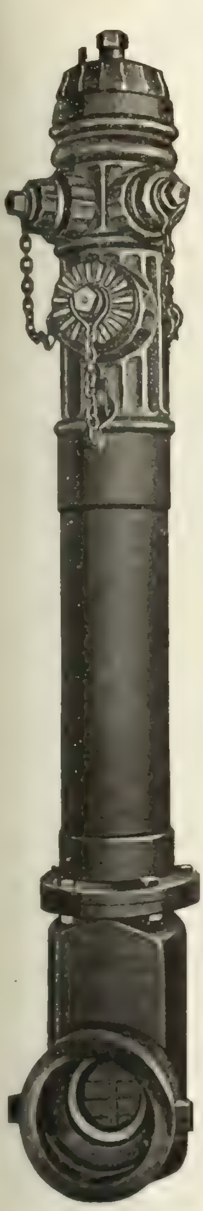

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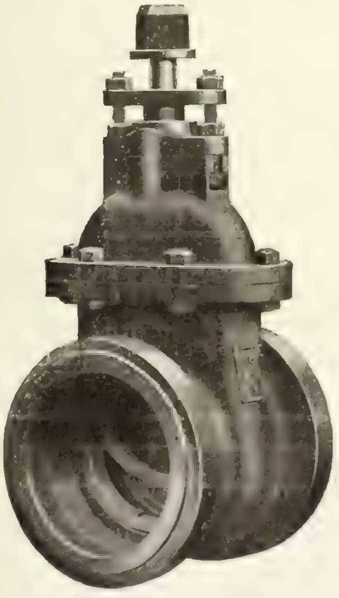

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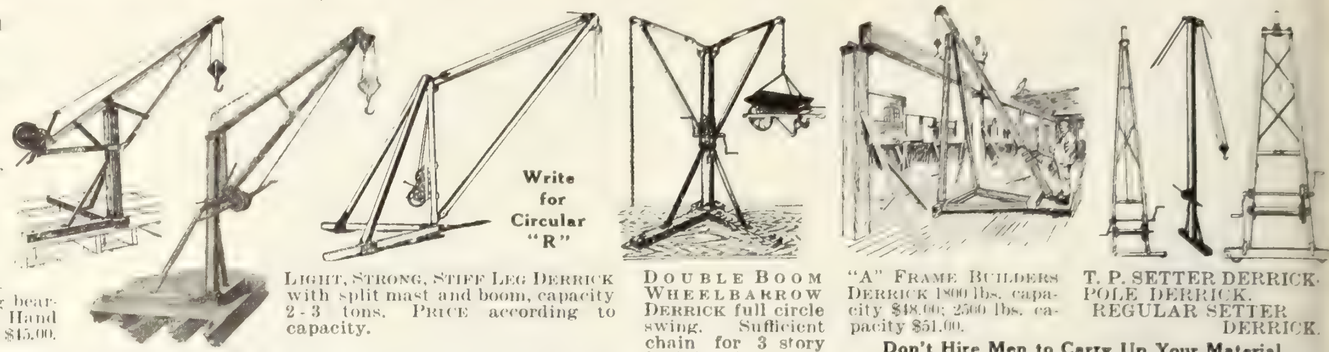

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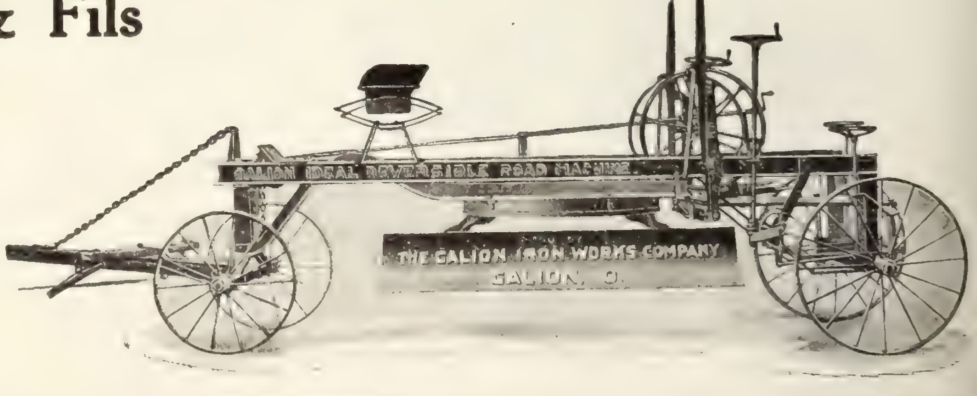
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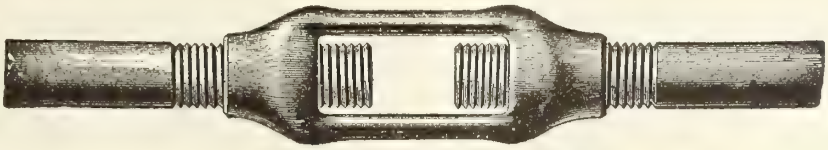

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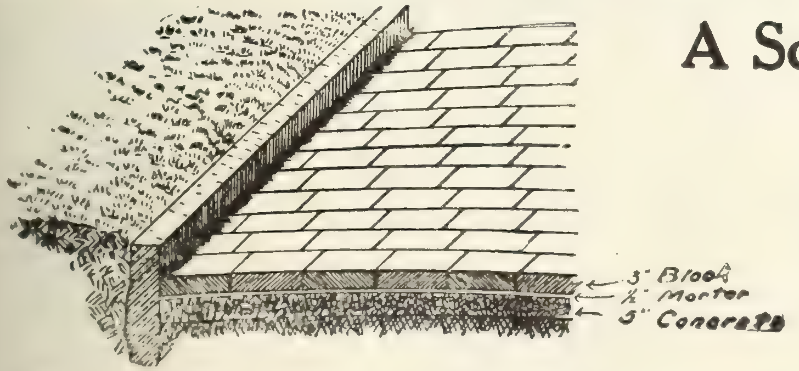

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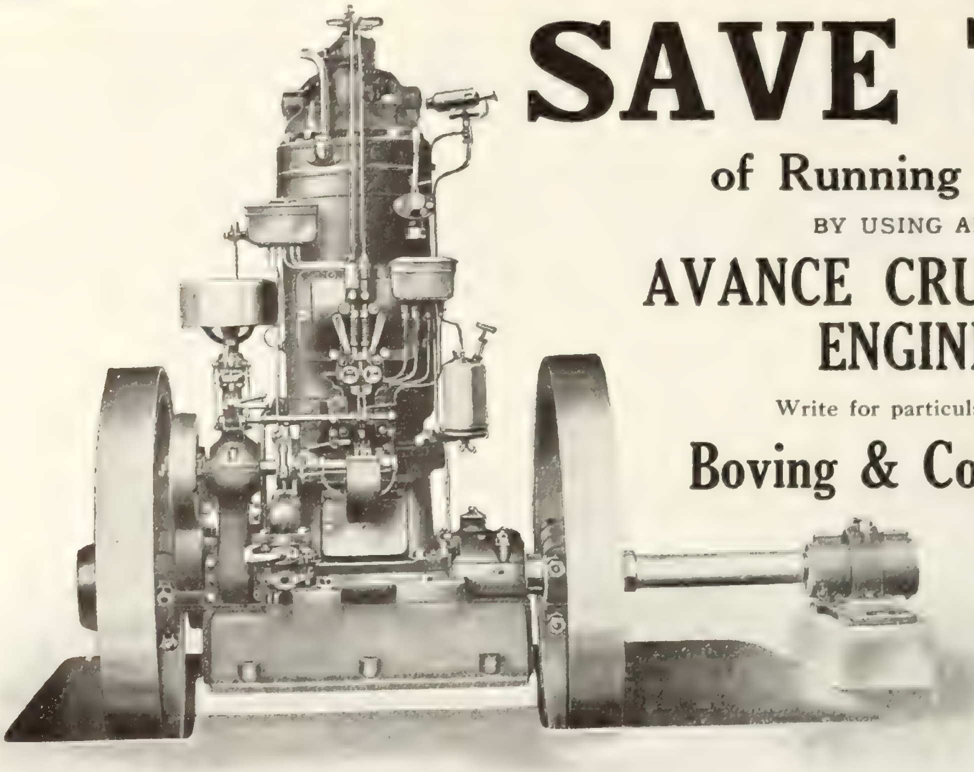

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Stuccos which become mottled, stained and discolored by iron and foreign matter contained in the sand, spoil the effect of many good architectural designs.

Sand, which is necessary in most stuccos, contains iron and other foreign substances which cause stains. Sand stuccos also lack the elasticity necessary to resist cracking.

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requires no sand because composed of Portland Cement and Asbestic—which is asbestos rock and fibre ground together.

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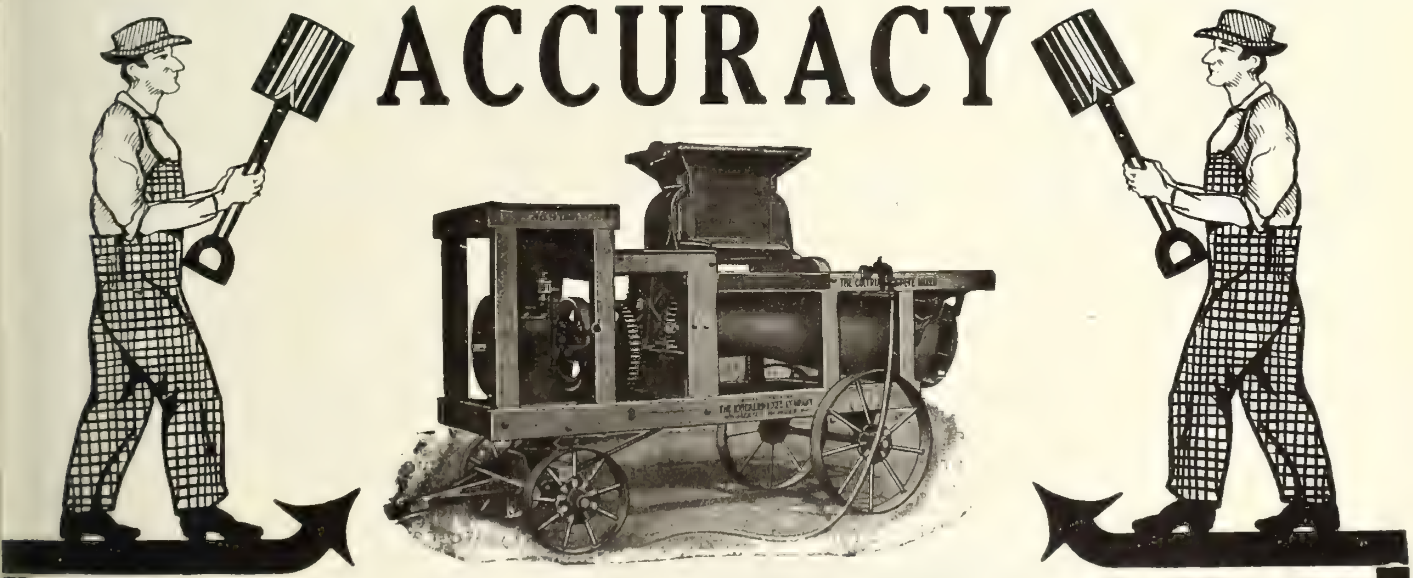
ACCURACY



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FIRST OF ALL COMES ACCURACY. The contract stipulates a definite strength mix. You as a contractor with a reputation at stake must adhere strictly to the specifications.

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A Successful Architect Can Make One Dollar Spent in Construction Do the Work for Which Another Will Need Two Dollars!

All baggy places in metal lath have to be filled out with plaster.
HERRINGBONE METAL LATH, (the Ribbed Kind) does not bag.

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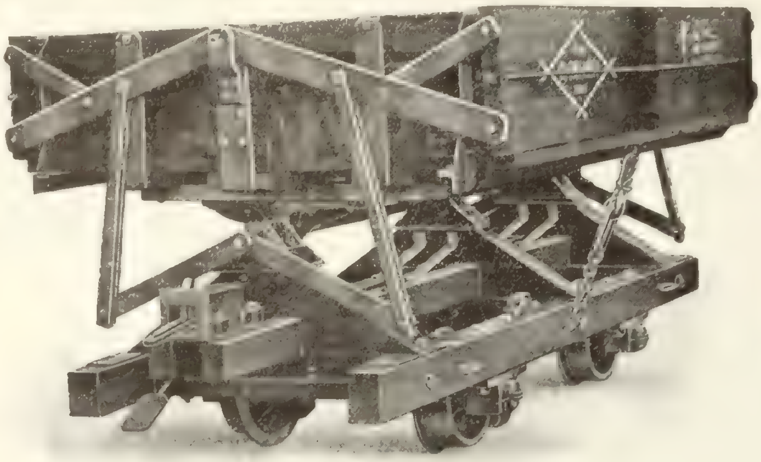

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Equipment is Used on all the Largest Contracts

Small Size Dump Cars

For contractors on small jobs, or for jobs where larger capacity cars are not required.

"GLENGARRY" 1¼ AND 1½ YD. TWO-WAY SIDE DUMP CARS

A great many contractors have found the above sizes very handy for certain jobs. These cars are strong enough for steam shovel use, but we recommend them for hand shovelling and horse draw. They have all the good features of this famous line of cars and differ only in size. Each door can be thrown up, or both doors together so that shovelling can be done from both sides at once. Being shipped in the knock down in carloads they load many more than other makes.

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By Using a

THEW SHOVEL

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The contractor with men and teams cannot compete successfully with the man who owns a THEW SHOVEL.

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It will pay you to investigate this shovel. Write for our catalog, C. R. It will explain the numerous features which make the Thew the most practical and economical machine of its kind on the market and will give you valuable information regarding cost of excavating.

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for all kinds of concrete work

Made with strong cast iron bases in following sizes:

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and can be supplied with wood or gas pipe handles.

Our prices are lower than can be procured elsewhere and we can supply them in lots of one dozen or by the carload.

Made in correct shapes and are strong and durable.

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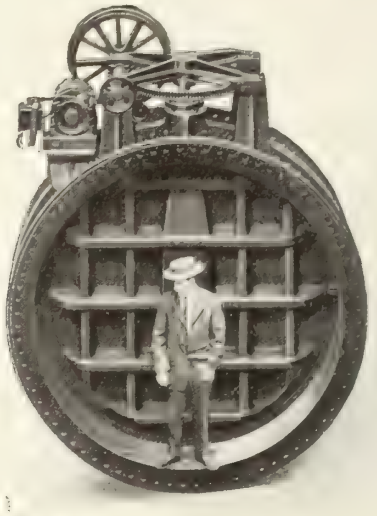

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For Greater Protection---For Longer Wear

¶The Goodyear Hose-making equipment is the most up-to-date in Canada. We have the latest improvements known to the trade. Every process is under the control of experts, who know the Goodyear requirements and see that a uniformly high standard of quality is kept up.

¶We take no chances with the raw materials. A stringent laboratory examination determines the quality of the raw rubber. The hard long-fibre cotton which is specially woven for Goodyear Hose-making is submitted to tests for strength and weave.

¶The walls of the hose are composed of long strips of cotton fabric thoroughly impregnated with rubber or friction. And cut on the bias to resist expansion, bursting and elongation. This friction-impregnated fabric is rolled under great pressure, which ensures a perfect union of the plies.

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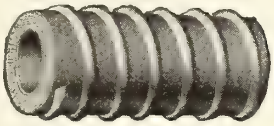
¶We build into Goodyear Hose the same strength and indestructibility as have made Goodyear Rubber Belts famous. Goodyear Suction Hose is steel-wound internally to guard against collapse. The coil is of round or flat wire, and round it the hose is built up, ply upon ply of rubber-permeated cotton fabric. This fabric is made from special hard-staple long-fibre cotton, and is cut on the bias to give strength and hard wear.

¶ Goodyear Suction Hose is made for every purpose – and can be had rough or smooth bore. Is in service throughout Canada—on wrecking and dredging contracts—in factories and mines—on farms and in saw-mills. Special hose made for sand-sucking, oil, gasoline, vinegar and acid, wine, etc.



STEAM HOSE

¶Steam Hose gets more hard usage than any other hose. In the Boiler Room it lies around near the furnace and is scorched—a hot firing tool is carelessly thrown down upon it—oil is spilt over it.

¶Goodyear Steam and Hot Water Hose is made with special heat resisting lining, which keeps the extreme heat from the friction fabric. This gives the extra durability—it will stand up well under hard usage. In its manufacture the materials undergo special treatment to resist oil—so destructive to common hose. The rubber and duck used in Goodyear Steam Hose are specially tested for service under high pressure of steam and hot water. We supply it steel wire wound or marline jacketed.

GOODYEAR RUBBER HOSE

AIR HOSE

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¶ Goodyear Air Hose will give good service under intermittent pressure.

¶ In mines, engine and boiler works, steel construction contracts—wherever pneumatic tools are being operated you will find Goodyear Air Hose. Wire or marline winding or marline jacket

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THE GOODYEAR TIRE
THE GOODYEAR TIRE & RUBBER CO. OF CAN
THE GOODYEAR TIRE

GOODYEAR MILL HOSE

¶When Mill Hose is wanted it is wanted badly. To find that your Mill Hose has cracked and rotted while lying idle is serious. **"Goodyear Underwriters"** is always ready for effective service. We build this hose to meet the requirements of the Associated Factory Mutual Fire Insurance Companies It bears the required stamp of approval "tested to 200 lbs. pressure." The inner tube is made from N E W Rubber of the highest grade, uniform in thickness and quality. The cotton fabric is of special circular web woven to the Underwriters' specifications for a minimum of expansion or elongation under pressure. It is antiseptically protected against rot and mildew.

¶For Factories and Mills the "Goodyear Underwriters" is a hose which will lower insurance rates, and cannot be excelled in durability and strength. You see it everywhere—the hose with the black and yellow stripes

112

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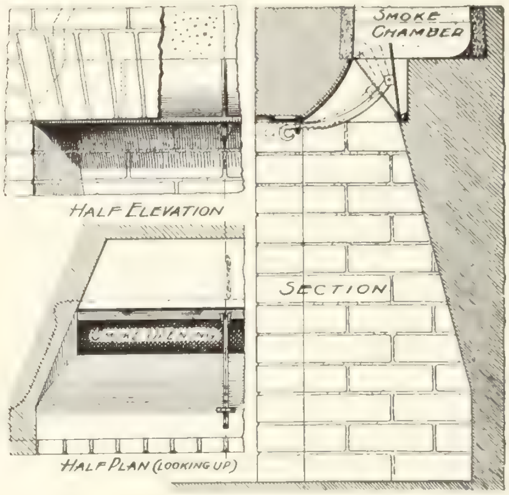

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Simplifies Mason's Work and Saves His Time.
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Simply and Strongly Constructed.
Cannot Get Out of Order.
No Complicated Regulating Gear nor Piercing of Brickwork for Operating same.

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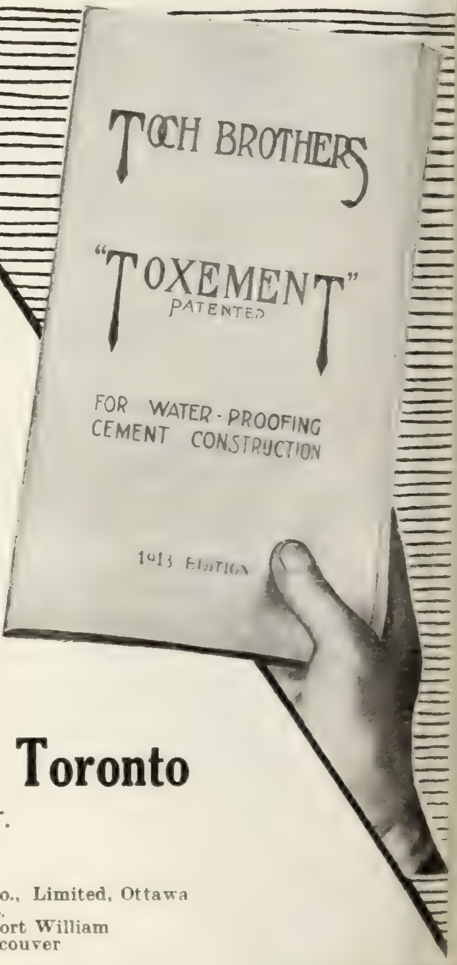

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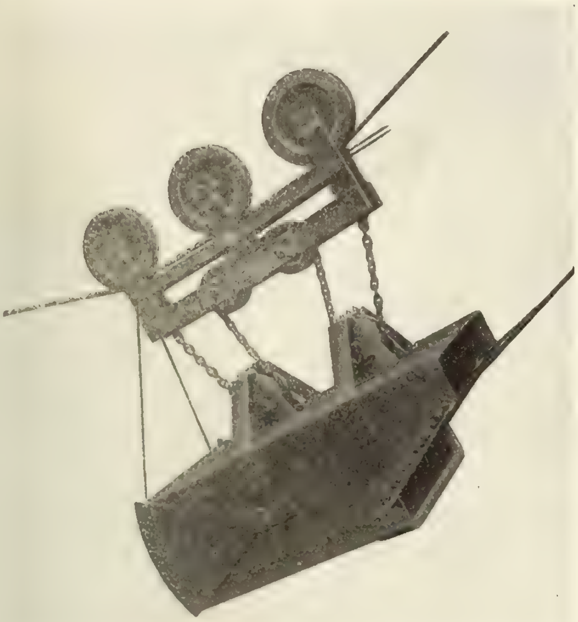
THE DULL DRAG LINE EXCAVATOR



Are you about to commence a contract embracing any rehandling or stripping operations? Dull's Drag Line Excavator with Rear Dumping Bucket may save you money. We will gladly send you complete description and prices.

OPERATING costs are reduced and working speed increased by the improved design of the Drag Line Excavator of gravity return type built by Dull.

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The great economy feature of our excavators is that they discharge with a minimum amount of power and with less strain on the ropes and hoist.

Dull's Rear Dumping Bucket for Drag Line Excavator, shown in illustration, has in a brief time become a very popular piece of equipment on rehandling and stripping work. It is obvious that a bucket that dumps without requiring the additional operation of turning it over—saves power and time and reduces expense of upkeep.

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City Awards Without Tenders

THE recent action of the Montreal City Council in awarding to the Elder-Elbano Company the contract for next year's supply of asphalt at $26.00 a ton without calling for tenders is open to criticism in whatever light it may be viewed. The defence is that under the arrangement effected the council can obtain any quantity of the asphalt they like without stipulating the amount in the contract and that the quality of the asphalt is beyond dispute, it having been in use for some three years. One of the authorities indulges in the open confession that it is sometimes necessary to "take a chance" in purchasing material ahead of requirements.

In this instance we are persuaded that the element of chance is entirely in favor of the successful contractor. Fortune can favor the Montreal ratepayer only in the unlikely event of an extraordinary scarcity of asphalt which would cause the material to soar above the price contracted for by the city.

There are cases in which the field is so restricted that calling for tenders would be a mere formality, but this argument cannot be adduced in favor of the course taken at Montreal. One of the controllers admits that an offer at $21.00 a ton was declined on account of the doubtful quality of the asphalt. Could not this doubt have been removed by submitting the material to a testing expert?

But there is another consideration which would seem to indicate that competition was not sought for. A local building supply firm declare that if tenders had been asked they would have put in a price of $25.10 a ton for asphalt which comes from Vera Cruz, Mexico, only five miles away from the source of the Elder-Elbano Company's supply.

Figuring the amount of asphalt which the city will use at eight thousand tons, the difference between $25.10 and the accepted figure of $26.00 means a loss of $7,200.

One's state of mind in considering such a matter is complex. It is difficult to determine whether the dominating feeling permits one to congratulate the Elder-Elbano Company, to condole with the ratepayers or to censure the administration.

All things considered, perhaps the most abiding impression is that the city authorities should not have the power to award such contracts without calling for tenders. Awards of this kind are not calculated to promote an observance of the unwritten code of contracting ethics.

The Gratuitous Bid

UNDER some such title as "The Ethics of Tendering" a work would make interesting reading, especially having regard to the fact that ethics play but a small part in this preliminary to a contract. In the everyday business transaction the labourer is deemed worthy of his hire. The reward may be small to negligibility and may be utterly inadequate to the services rendered; none the less, commerce is not based upon philanthropy, and payment or promise of payment is the basic condition in every business transaction. Contractors, as a class, stand apart. They alone among men are required to render gratuitous service, and it must be remembered that to refuse such service would spell certain bankruptcy. That a contractor is a man who carries out contracts is an obvious definition within the intelligence even of Macaulay's schoolboy, and it is equally obvious that before a contract can be obtained a competitive tender must be submitted. For this preliminary work the contractor is paid nothing, and insult is added to injury by calling upon him to pay a lump sum down—returnable possibly, but none the less payable—for the privilege of having his gratuitous work considered side by side with other and similar gratuitous work.

It is argued by those interested in preserving the present system that no other course is possible. Prices, and competitive prices necessarily, must be obtained, and the contractor must rest content with his sporting chance. He obtains at least a percentage of the jobs for which he tenders, and what he loses on the swings he can very well make good on the roundabouts. But there is another way of looking at it. A contract is advertised and thirty men go to the trouble and expense of pricing the bill of quantities. Now of these thirty men, twenty-nine stand to get no return whatsoever. Their work must be purely gratuitous, without reward either present or future, and the same thirty men will compete again and again with each other, with a similar result. There would be some element of scant justice if failures went to a man's credit, if, in other words, repeated tendering insured some degree of preferential treatment. But this is not so, and the evil has grown apace, until men have been forced to recognise the fact that cut prices are the only road to success. And with cut prices—cut only too often below the actual cost of honest workmanship and good material—have come scamping and subterfuge of a virulent type. The contractor is the last man who should be blamed. He is merely the victim of a pernicious system, to the code of which he must conform if he would live.

The sole alternative is to pay the contractor for the trouble he is put to in tendering and to reimburse him any expenses he may incur. Only those who have been behind the scenes can appreciate the amount of labour involved in pricing a large bill. Beyond the actual pricing there will be visits to the site of the proposed works and to the offices where the plans are deposited; inquiries galore will have to be instituted concerning local prices, transport facilities, time deliveries and a hundred and one other items; while rough tracings and a precis of the specification have not infrequently to be made. Now, is there any reason why all this should be done, say, twenty-nine times over, for nothing? To pay for services rendered would add necessarily to the expense of the job, but surely it is not fair to expect nine-and-twenty men to relieve the employers of what amounts really to a legitimate expense. The employers benefit (or hug themselves in the belief that they do benefit) by competitive tendering, and there is no reason on earth why a portion of the expenditure they are saved in the carrying out of the work should not find its way back into the pockets of the unfortunate twenty-nine who are left out in the cold. As matters stand now an employer can obtain a hundred prices without one penny of expense, and (deeper depth) he need not even accept one, owing to that delightful clause "the lowest or any tender will not necessarily be accepted." From whatever standpoint the matter is viewed, one broad fact remains, and that is that it is grossly unfair and commercially immoral to compel any body of men to work for nothing. Tradition, custom, expediency—these may all be urged in extenuation, as they have been urged over and over again in extenuation of almost every other injustice perpetrated by man upon his fellows. But the bedrock fact remains; and one may leave it at that.

Competitive Tendering

COMPULSORY and gratuitous competitive tendering brings many evils in its train, among which scamped workmanship and inferior materials take an easy first. The lowest tender is almost universally the one accepted, and the whole ingenuity of the estimating clerk must be directed towards cutting things fine. A full and well-drawn bill, without errors or omissions, is his despair. His work must then be confined to pricing and extension. But his chance comes with a lax bill, and if he knows his work he is quick to take advantage of it, subject of course to the approval of his boss. Thus, an important item may have been under-measured, and extras on it will arise upon final adjustment. This item he prices high—as high as the job, having regard to the total, will stand. Another will be over-measured and this, with the inevitable deduction starting him in the face, will be priced correspondingly low. The two items may be made to equal each other so far as the total goes, but the very reverse takes place on settlement. An omission may be prepared for in similar manner, the scheduled items of work being so manipulated as to return a smart profit when it is valued. Careful inspections of the site, after as careful a perusal of the plans and specification, will often reveal a lot to the experienced contractor. He will realise difficulties which have escaped the notice of the engineer, and will be able to anticipate to a nicety the variations, omissions, and additions which together may not only save the loss inevitable upon his cut prices, but may return him a fair profit. Assuming however that the bill is absolutely correct, and that nothing in the way of variations, omissions and additions arises, the engineer is in for a worrying time if the accepted tender has been cut too fine. Even a contractor must live, and unless he be in a big way and prepared to meet his losses, circumvention of the engineer is his only chance. A warfare of wits commences from the day the first sod is turned, and who will win lies on the knees of the gods. Many an engineer has built up a reputation by "breaking" contractors, but on the other hand a dishonest contractor has many a time and oft ruined the reputation of the engineer.

Now nothing of this kind should be necessary. Work is to be done, and the man who does it should be paid its cost with the addition of a certain profit. It is absolutely immoral and dishonest to compel an unfortunate man to continue the execution of work upon which he is losing large sums. There should be some method of arbitration, some court before which a case could be argued and the contractor afforded what measure of relief he might be entitled to. It is obviously wrong that an employer should reap a profit from the contractor's loss. For every evil of this kind competitive tendering, with the acceptance of the lowest tender, is primarily to blame, and censure should be placed upon the engineer who recommends his client to accept a price palpably below that at which the work could be creditably performed. The acceptance of the lowest tender but one is a way out of the difficulty and a case for it has been ably argued on many occasions. Space does not allow the points urged in its favor to be detailed here, and it must suffice to say that the adoption of the system would give the deathblow to cut-throat tendering, for a man would have to be as careful not to go too low as he is now not to go too high!

The system of deposits is one against which contractors should clamour in a common voice. To ask a man to submit with his tender the name of two personal sureties or the bond of a guarantee company is carrying things quite far enough; but it is simply iniquitous to demand the deposit of ten per cent. of the amount of the tender, for forfeiture if he decline to sign a contract or fail to complete his contract in accordance with the terms of the tender. A man may have excellent reasons for withdrawing his tender, especially when he has seen the tenders of his competitors. A mistake may have been made, the price of certain materials may have gone up during the time that has elapsed between the submission and acceptance of his tender, labour troubles in certain trades may be pending, other and more favourable work may have come in—there is no end to the reasons which may prompt a contractor to desire withdrawal, and why in the name of everything honest should a man not be allowed to change his mind (for a good and sufficient reason) at any time before the actual signing of the contract? Delay in the carrying out of this formality may itself offer good cause for withdrawal, for in certain classes of work the season of the year in which it is commenced may mean just the difference between profit and loss. Then when the work is well in hand things may go wrong with the contractor. He cannot proceed; and his ten per cent. deposit on the whole sum stands forfeited. In common fairness the employer should at least deposit an equal sum with the contractor, so that, if for any reason for which the employer is responsible the contract is not signed, or having been signed is not completed, the contractor may annex the deposited sum. As matters are, he stands to lose on every count.

Hamilton City Engineer's Suggestion

In our issue of November 5 we referred editorially to the suggestion to have the proposed Canadian municipal engineering organization affiliated with the Institution of Municipal and County Engineers of Great Britain. Apropos of this suggestion Mr. A. F. Macallum, City Engineer of Hamilton, writes us as follows, offering a counter-suggestion:—

"I do not see what can be gained by affiliation with the Institution of Municipal and County Engineers. While the editorial sounds very plausible, the conditions are not parallel with ours, as are those existing in the country to the south of us—facetiously called "the land of the free." While such amalgamation might be of slight mutual benefit, yet it would not be nearly so considerable as in the case of amalgamation with the American Society of Municipal Improvements, which has now just absorbed the Society of Standard Specifications and whose problems and municipal endeavors are identical with our own. Several municipal engineers are already members of this society,—in fact Mr. C. H. Rust, of Victoria, is a Past-President. A perusal of their proceedings will show the benefit that would be derived from such an association."

The Good Roads Movement

The great scope for the Ontario Good Roads Commission was shown conclusively at the recent meeting in Ottawa which was attended by representatives from almost every municipality in the Ottawa valley. It will be remembered that this commission was appointed by the Ontario government last July to investigate the good roads movement, particularly in the older and more settled portions of the province. It will submit a report making suggestions as to how the interests of the movement can best be promoted. The commission has visited various parts of the United States, and members have attended conventions where the good roads problem has been taken up. With a view to awakening public interest a series of meetings at different points in the province has been arranged, with the object of giving those interested an opportunity to come forward and express their views on the subject—a subject, which as expressed by the chairman of the commission, "begins with the assessment roll and ends with greater facilities and comfort in the conduct of the business of the entire country."

The Commission as a body is well equipped for the work in hand, comprised as it is of Mr. C. A. McGrath, of Ottawa, the chairman; Mr. A. M. Rankin, M. L. A. for Frontenac, and Mr. W. A. McLean, chief engineer of the Provincial Department of Highways.

The appointment of this commission by the Ontario government is intended doubtless to lead to a larger and more complete organization for road building. It may be expected confidently that it will lead to such an organization as will create permanency in every respect, for authorities and public alike are coming to a general appreciation of the fact that good roads are essential to the greatness of any country.

One of the most encouraging features of the meeting at Ottawa was the high type of opinion expressed by those giving evidence for the commission, showing that the people realize the magnitude of the good roads question and that they are thinking carefully along the line of more efficient organization. There is an intensity of public interest which will overcome all obstacles, just as the intensity of public interest in road building overcame incomparably greater obstacles in the days of the Roman ascendancy. The ready response which the commission met at Ottawa is most significant.

Among the many valuable suggestions received mention may be made of a main road between Ottawa and Prescott; a main road along the St. Lawrence shore; a permanent Highways Commission; general Government supervision of local road construction; a fixed Government standard for local road construction; the abolition of statute labor; and a centralization of control such as would ensure uniform local development.

Electrical Sterilisation of Water

A NEW electrical water steriliser is described in a recent issue of the Engineering Record of New York. This is a direct-current sterilising machine, for which it is claimed that it will remove colour from the water, and that it will destroy and remove all vegetable matter and pathogenic germs, leaving the water bright, sparkling and full of oxygen. It is to be noted that the electrical process is followed by settlement and double filtration, so that the process is not entirely electrical.

In this particular apparatus the water passes first through an electrode box consisting of a series of pure iron plates separated by marginal insulating gaskets. These plates are perforated at alternate ends, so that the water passes through the holes and between the plates through the whole series, and is exposed in a film to the surfaces of the plates in succession. Electric connections are so arranged that the entire series of water films is in the circuit at the same time. The effect of the current passing through these films of water is partly to dissociate the hydrogen and oxygen of which the water is composed, and at the same time to throw off hydroxide from the pure iron plates. The oxygen in its present form permeates the entire water body, and by oxidation is said to assist in destroying all animal and vegetable life in the water. The iron hydroxide surrounds the matter in suspension, forming a sponge-like mass. The water then passes from this electrode box into a settling chamber, where the heavier matters settle. Thence it passes to a filter, through which it flows to a second filter, after which it is ready for consumption. There are special arrangements for preventing clogging of the filters and for cleaning.

The machine works with a direct current of from 110 to 220 volts, and the electrode box is arranged to take any number of plates, the voltage between the plates being regulated by the number of plates put in series.

The machine is controlled by the Electric Water Sterilising Company of Scottdale, Pennsylvania, and is said to be an improvement made by Mr. H. B. Hartman over his patents of 1909 and 1910.

A steel bridge of continuous-arch type has been built over the Drau River at Marburg, Germany, and was recently opened for traffic. The bridge comprises three main arch spans of 131-ft. span each, made of girder ribs. The ribs of adjoining arches are continuous where they meet and are supported on the river piers by segmental roller bearings. The thrust is taken by the end abutments only. Unequal loading of adjoining spans producing differences in thrust must, therefore, be taken care of by distortion of the arches. The steelwork of the bridge amounts to 1,000 tons.

Greater Vancouver Sewerage Scheme

Organizing and Financing Project for Draining 55,600 Acres, with Data on Rainfall and Float Tests of Dispersion of Outfalls

THE very rapid increase of population in and around Vancouver, B.C., requiring a corresponding development of sewerage systems, has brought about the necessity for more or less sewer construction in the near future in each of the natural drainage basins of Burrard peninsula. This peninsula includes 55,600 acres, of which only 9,500 acres are within the present boundaries of Vancouver, the remainder being in New Westminster, South Vancouver, Point Grey and Burnaby. However, the ultimate necessity of a joint sewer system embracing the entire peninsula was early recognized, and in 1910 steps were taken to secure united action before there should be constructed by any of the independent municipalities, sewer systems which might not harmonize with the scheme most desirable for all.

Accordingly, in April, 1911, the several municipalities, with the exception of New Westminster, appointed a committee, composed of two representatives from each council, for the purpose of inquiring into the best means of placing the question of sewerage and sewage disposal on a sound and permanent basis. This committee retained Mr. R. S. Lea, consulting engineer, of Montreal, to advise them as to a general scheme for the whole peninsula and the best means of constructing and maintaining such a scheme in a state of efficiency. Acting on these instructions, a comprehensive report was submitted early this year and adopted by the joint committee.

The report advised the formation of a permanent sewerage board, and in February, 1913, there was drafted an act, based on the recommendations of the report, forming such a board. The Provincial Government was then approached with a request for legislation, and at the same time was asked for financial assistance in the form of a Government guarantee for a bond issue. With some minor amendments, the act passed the legislature and became effective August 1, 1913.

This act virtually gave Government sanction to the board of control, a Government guarantee to secure the bonds which would furnish money for construction and empowered the board to construct and maintain sewer systems in accordance, substantially, with the report which was submitted by Mr. Lea. The act provides that the chairman of the board shall be appointed by the Lieutenant-Governor in council, the other members also being so appointed on recommendation of the municipalities which they represent. The chairman and other members of the board "remain in office during the pleasure of the Lieutenant-Governor in council," who fixes the salaries of each.

The Government guarantee covers the interest on the $10,000,000 for which the board is empowered to issue bonds and $5,000,000 of the principal. Anticipating the possibility of some time being required to dispose of the bonds, the board has been authorized to borrow $350,000, so that there shall be no delay in carrying out that part of the work required at once.

It was proposed to finance the sewer development on forty-year bonds and to design the systems so as to be of adequate size for handling the sewage of the probable population in 1950. In order not to burden the ratepayers of to-day with an excessive capital outlay on sewers for future needs, estimates embodied in the report were divided into "immediate construction" and "deferred construction"—the former covering work to be carried out during the next five years at a cost of $5,500,000 and the latter covering the probable extension in the ensuing twenty-five years at an approximate cost of another $5,500,000. This plan makes it possible to go ahead immediately with sewer construction wherever needed, and at the same time co-ordinates the work in various districts so that all is combined into the most advantageous system.

Population Curve

For the purpose of estimating the population increase of Vancouver the growth of six American and three Canadian cities has been plotted, as shown in the accompanying diagram, the starting point in each case being taken at a time when the city had a population of 150,000, which was approximately the population of Burrard peninsula in 1911. On this chart it is noticeable that inland cities show a slower rate of growth than seaports, and also that there is a great difference in rates. Growing at the rate that applied to Boston in the forty-year period following the 150,000 stage, Vancouver would have a population of 500,000 in 1950, while if it grew at Chicago's rate the population in 1950 would be 2,000,000. The curve for Vancouver has been plotted midway between that of Chicago and New York, and the sewer development has been designed so as to permit of its being extended from time to time until there is provision for a population of 1,400,000.

Five Drainage Areas

Burrard peninsula is divided naturally into five drainage areas, which discharge respectively into Burrard Inlet, False Creek, English Bay, Fraser River and Burnaby Lake. Each of these areas was studied as a separate problem in laying out the general scheme, except that the disposal of sewage from each area was considered in the light of its relation to the other districts or the waters there available for dilution. The volume of sea water subject to tidal flow which was adopted as necessary for diluting sewage without nuisance or injury to fish life was taken as 100 times the quantity of sewage involved.

The average rainfall in Vancouver for the last seven years has been 56 in. per annum. During 1912 careful records kept at New Westminster showed that on only three days did more than ¼ in. of rain fall in an hour. On the other hand, very heavy downpours occur at rare intervals, and drain capacities are required for storms such as the one that occurred in June, 1913, when there was a precipitation of 0.45 in. in ten minutes and 0.9 in. in thirty minutes. The sewerage systems now under way, however, are being constructed on the combined system, with the exception of the False Creek and English Bay areas.

English Bay and False Creek

The total area draining into English Bay and False Creek is 8,650 acres, which is estimated to have a population of 270,000 in 1950. The standard of purity demanded for the foreshore waters of English Bay is high owing to the presence of bathing beaches, and for the area affecting these waters a separate sewerage system is advised, limiting the combined system to those parts of this basin where is has already been installed. The point of discharge selected for this area is in English Bay, some 5,000 ft. out from the shore on the line of Imperial street. The first outfall pipe will be 60 in. in diameter, and will be carried out, at first, a distance of 3,000 ft. and will be extended and other outfall pipes added as the population increases. One of the reasons for selecting this outfall location was that there is a stretch of level land near by on which some form of sewage-treatment works could be installed, should these become necessary at some future time.

The route to be followed by the interceptor passes first along the high-water mark on a grade of 1 in 2,700, the sewer here having an inside diameter of 9 ft. and beginning with its invert elevation 93 ft. above the city datum. At Balaclava Street, meeting the Balaclava sewer, the diameter decreases to 8 ft. and the interceptor continues on a grade of 1 in 2,400. Five main trunk sewers feed this interceptor, as well as two low-level areas from which sewage will eventually have to be pumped. The largest of the five contributory areas is served by the Balaclava trunk sewer, 2,350 ft. of which has already been completed. This completed section has an inside section 10 ft. 4 in. wide by 8 ft. 3 in. high, and pending the construction of the interceptor has a temporary outfall direct into English Bay.

Float Measurements

Before selecting the location of the Imperial Street outfall numerous float experiments were made to determine the point where the best diffusion could be obtained. The accompanying chart shows the average dispersion of floats for various periods of time. The floats used were cut from 6 x 6-in. timber in 2-ft. lengths, and were weighted so as to float upright. It was found that the Fraser River caused a definite current from Point Grey to the First Narrows at all stages of the tide, the effect being more marked during the high stages of the river. Between this line and the shore there was found to be at all times a circular, clockwise movement of the water. The two float charts reproduced herewith show what comparatively slight advantage there would be in placing the outfall at the extreme end of Point Grey, although at first sight this might seem to be by far the more desirable location.

Fresh and Salt Water

An important feature of the Fraser River effect on English Bay is that the fresh water spreads out above the salt water and covers a larger area than would be the case if these waters, by reason of temperature differences, mingled along the line of contact. The Fraser River water normally extends to a depth of 10 feet below the surface, the depth reducing to a thin sheet along the line of advance of an incoming current. The river water carries much glacial silt and its muddy color readily distinguishes it from the clear water of the bay. This color difference often makes the slight depth of the overlying fresh water apparent in the wake of vessels, a path of clear water marking that which has been churned from below by the propeller. The surface blanket of fresh water will have a beneficial effect on sewage dilution, it is believed, because of its lower specific gravity, which will retard the tendency of sewage to float. Although the prevailing winds at the outfall are off shore, arrange-

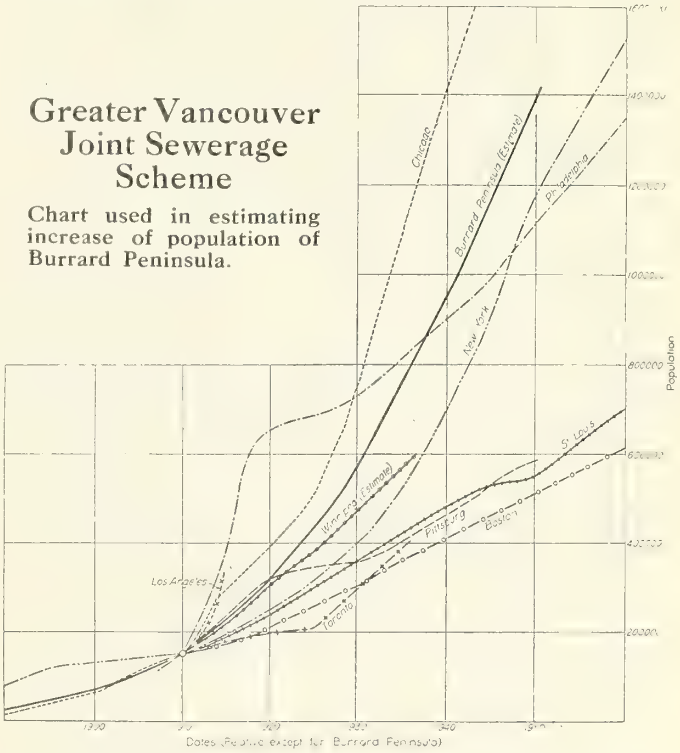
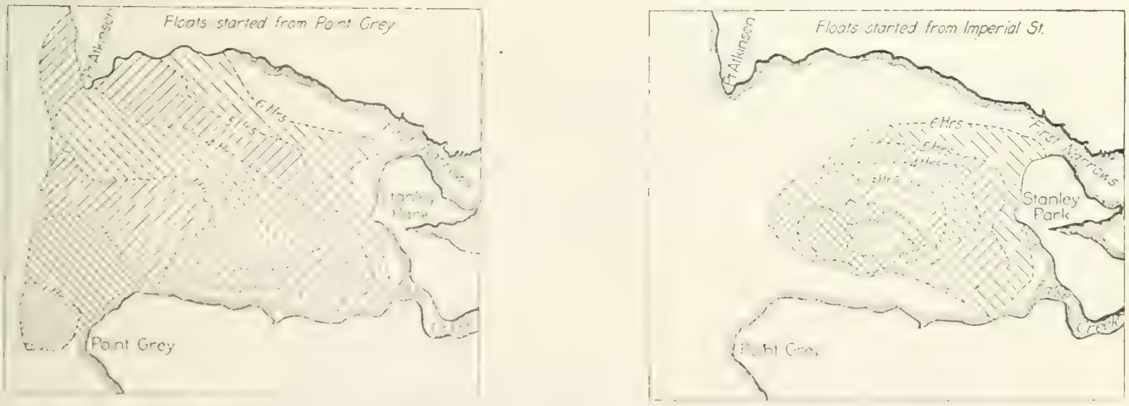

Greater Vancouver Joint Sewerage Scheme

Chart used in estimating increase of population of Burrard Peninsula.



Dispersion in English Bay of floats starting from two different points.

ments are to be made for the interception of all floating matter, so as to prevent the possibility of any of it being carried back and strewn along the beach.

False Creek has an area at high tide of about 1½ sq. miles, and the volume entering it on a 10-ft. tide is about 1,600,000,000 gal. Due to the fact that there are bathing beaches on either side of its outlet, it is not considered a suitable place for the dilution of raw sewage. It is, however, looked upon as a relief outlet, in times of heavy storm, for those adjacent areas where the combined system is in use.

Burrard Inlet

The principal discharge into Burrard Inlet will be through an outfall located at Clarke Drive, which is to drain an area of 8,250 acres, with a population, it is estimated, of 238,000 in 1950. Parts of the area being made tributary to the Clarke Drive sewer would naturally drain into False Creek and Burnaby Lake. In view of the fact that the upper part of False Creek is about to be filled in, it is recommended that suitable provision be made prior to this fill for a relief outelt, which would come into use should the Clarke Drive outfall become gorged by any extraordinary rainfall.

In rating the capacity of Burrard Inlet for diluting sewage it was assumed that at some future date a dam might be thrown across the Second Narrows. For this reason, only that area between First and Second Narrows was considered available, and of this area one-half was figured as belonging to the north shore. Thus, omitting as before the low-water volume, there remained one-half the tidal volume between the First and Second Narrows, which would, on a basis of 1 to 100, effectively dilute the sewage from a population of 1,200,000. Besides the Clarke Drive trunk there are smaller sewers which are to discharge in Burrard Inlet, the largest being the Hastings Park outfall, draining 800 acres. The only requirement for these smaller sewers is that the outfall pipe be carried beyond the pier line into deep water.

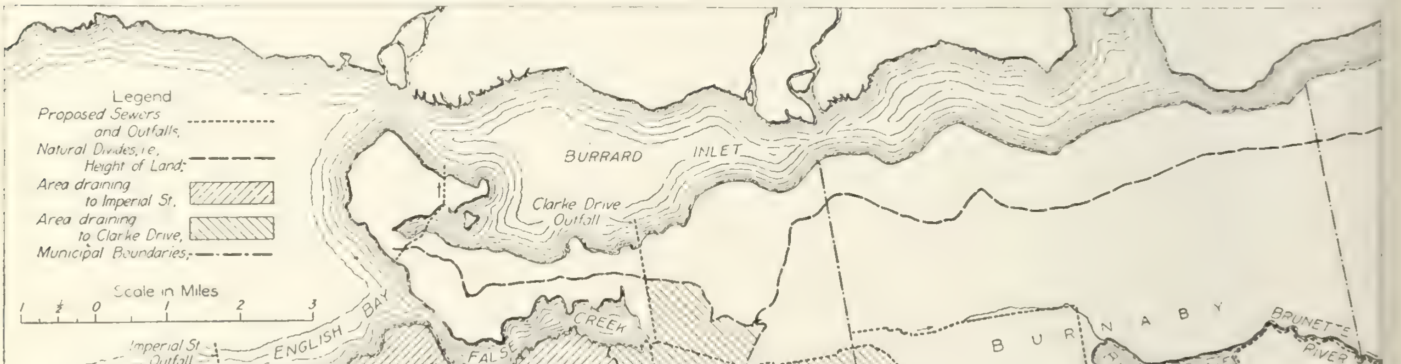
Because of there being little through current in Coal Harbor no outfall will be permitted between Brocton Point and the Canadian Pacific Railway wharf. The present sewers discharging into this area are to be intercepted and the sewage carried across to the northeast shore of Stanley Park, where the tidal currents run as high as 9 knots per hour.

Burnaby Lake

Burnaby Lake has a mean water area of about 430 acres, with a maximum depth of 9 ft. After a period of dry weather it is practically stagnant and not capable of digesting any amount of raw sewage. The total area draining into this lake is about 26 square miles, which has its only outlet through the Brunette River. By 1950 it is estimated that the population of this watershed will be about 200,000, and the placing of streets and roofs over the present highly absorbent soil of the basin will materially change the runoff. It is estimated that with this population the heaviest storms will give rise to a runoff from the watershed of at least 4,000 sec.-ft. That is to say, assuming a velocity of 5 ft. per second and a channel depth of 10 ft., the outlet will have to be 80 ft. wide. It is pointed out that it will be of the utmost importance to conserve the natural drainage channels of this district. In the estimates for "immediate construction" there is an item of $200,000 for improving Still Creek and the Brunette River and providing two interceptors for sewage disposal during the next five years.

Fraser River

The minimum discharge of the Fraser River, occurring in March, amounts to about 20,000 sec.-ft. at Hope, B.C., which is 80 miles above New Westminster. The maximum flow, which comes in June, is about 40,000 sec.-ft. Just below New Westminster the north arm leaves the main river,, and the influence of tides here makes it difficult to determine the proportional flow down each of the channels. It is believed, however, that the flow in the north arm will never fall below 1,000,000,000 gal. per day under present conditions. This amount, on the standard basis of dilution, would handle the sewage from 100,000 persons. On the same



Plan of Burrard Peninsula. showing scheme of joint sewerage system for Greater Vancouver.

basis the minimum flow of the river would oxidize the sewage of 900,000 people.

The area contributory to the north arm of the Fraser River includes 17,000 acres, and in 1950 the estimated population on this area will be 250,000. To meet the needs of the district in the next five years the combined system trunk sewers indicated on the map have been provided for in estimates for "Immediate Construction." It is believed that the time will come when an interceptor will have to be constructed or some form of local treatment introduced in this area. Provision for the former has been made in estimates on "Deferred Construction."

The surveys, estimates and designs embodied in the report submitted by Mr. Lea were made under the personal supervision of Mr. A. D. Creer, Mem. Can. Soc. C. E., A.M.I.C.E., who is still in charge of engineering work for the Greater Vancouver joint sewerage board.—Engineering Record.

New Method of Concentrating Sewage Sludge

THE method which is mostly in use for concentrating sewage sludge is that of filter pressing. I have found that practically the same results that are obtained by filter pressing can be achieved in a far simpler and cheaper manner, writes Dr. Grossmann, of Manchester, Eng., in the Surveyor. In order to make my explanation perfectly clear it is necessary to begin at the beginning—that is, at the point at which the sludge is ready to be taken from the settling tanks.

It is stated in text-books, and generally accepted, that the sludge which is obtained from settling tanks contains from 5 per cent. to 15 per cent. and over of solid matter. With proper arrangements and management there should be no difficulty in obtaining from the settling tanks sludge which averages between 10 per cent. and 15 per cent. of solid matter, and even more.

I have on a previous occasion (Journal of the Society of Chemical Industry, January 15, 1912) gone into the question of sludge disposal, and I have shown there that, in making one's calculations on the proper basis—i.e., only reckoning the actual sludge worked up, and not including lime or precipitants which have been added (and which are only so much dead weight), the cake produced by filter pressing will not, on an average, contain more than from 25 per cent. to 30 per cent. of actual sludge, and that where centrifugal machines are used for the purpose the results obtained are even below these figures. I have also shown that in practical work the costs of sludge disposal by filter pressing are much higher than is generally assumed. This is due to the fact that, instead of stating the results obtained on the amount of actual sludge which has been worked up, the sum of the actual, precipitants and lime has been taken for that quantity, and thus rendered comparisons with regard to cost of different methods of sludge concentration and disposal entirely fallacious.

If, then, we have our calculations on the amount of actual sludge contained in the pressed cake we may take it that, as a fair average, it does not contain more than 27½ per cent. of actual sludge. I have found, as I shall show later on, that sludge of any description can be manipulated in such manner as to yield by settling a product which will contain from 20 per cent. to 25 per cent. (say 22½ per cent. on an average) of actual sludge, and the question arises whether it is worth while to filter-press sludge when such results can be achieved by far cheaper means. Of course, if we compare the consistency of settled sludge with filter-pressed cake containing the same percentage of actual sludge the latter appears more solid; but this is chiefly due to the percentage of lime which has been added in order to facilitate pressing and to obtain a cake of fairly solid consistency. That amount of lime varies considerably; it may be anything from 10 per cent. to 50 per cent. of the actual sludge and more; but lime is an expensive material, and where filter pressing is not resorted to there is no reason why another material whch would stiffen the consistency of sludge should not be equally applicable. The cheapest material of that kind available is cinders, and I have found that by adding from 10 per cent. to 20 per cent. of fine-riddled cinders to sludge of 22½ per cent. a mass can be obtained which in every way is equal to the average filter-pressed cake produced at sewage works, and whereas it costs from 2s. 6d. to 5s., and more, to obtain 1 ton of pressed cake containing 27½ per cent. of actual sludge, a product of the same consistency can be made from settled sludge of 22½ per cent. and cinders at a cost of less than 8d. per ton. Calculating this on 27½ per cent. instead of 22½ per cent., it is evident that the same amount of sludge as is contained in 1 ton of pressed cake can in this manner be disposed of at a cost of less than 1s. In many cases it will, of course, not be necessary to mix the settled sludge with cinders.

I have found that with sludge of from 10 per cent. to 15 per cent. or more of solid matter from the settling tanks, a tank of the description given in my Patent Specification No. 28328/1911, and worked on similar lines to those given there, will enable one to obtain sludge by secondary settling, which will vary from 20 per cent. to 25 per cent. according to the quality of the sludge; these tanks work very satisfactorily, with one drawback, and that is, that as the sludge in coming from the settling tanks cannot be obtained of uniform consistency, the time required for settling in these tanks varies. Further difficulties are encountered in the case of sludge which is in that peculiar stage of decomposition which lies between fresh sludge and sludge which has been completely septicised, and in which state the sludge becomes unmanageable so far as settling operations are concerned. I have therefore endeavored to discover a method by which sludge of any description can be concentrated in settling tanks to approximately 20 per cent. of solid matter, and I have ultimately succeeded in this. I have found that on mixing sludge with a small amount of acid and letting it stand for a few days a complete separation takes place. The sludge settles out at the top in a thick layer, while underneath is a clear, or almost clear, liquid, and the two can be separated by running off the clear liquid from the bottom. Any tank with an outlet at the bottom can be used for the purpose, but preferably I use a tank of similar construction to that described in the patent previously referred to, and in which the thick sludge obtained after running off the clear liquor below can be further concentrated by draining and filtering. The principle of the method consists in the fact that nearly all sludge contains sufficient sulphides and other compounds which, in contact with acid, produce gaseous matter, which surrounds the particles of sludge and acts in the same way in which a lifebelt acts with human beings, thus enabling the sludge to float on the top of the liquid. Practically, it thus produces the same result in two or three days which is produced by the fouling-out of septic sludge, which takes weeks and months. If a sludge should not contain a sufficient quantity of those substances which evolve the necessary gaseous matter a small quantity of septic sludge or other suitable material can be mixed with it before the addition of acid. I have worked this method (which is protected by application for Letters Patent) for some time at the Oldham Corporation sewage works on very troublesome sludge with invariably good results, and there is no doubt that the same result which is now obtained by filter pressing or centrifuging can be obtained in a far simpler and incomparably cheaper way by the adoption of my method of concentrating sewage sludge as described above.

Advantages and Disadvantages of Intercepting Traps*

I HAVE really very little to say in their favour. I am of opinion that where drains are laid underneath dwelling-houses or other inhabited buildings they should be trapped, unless they are constructed of heavy iron pipes embedded in cement concrete, in which case I would omit an interceptor. Many are so constructed in my district. They would probably be preferable also on steep gradients where thickly built upon, with the windows of one house immediately above the vent pipes of a lower one. But even this may be obviated to a considerable extent by dividing the sewer into lengths by means of a trap or flap.

In my opinion, the chief objections to interceptors are as follows:—

(1) Their liability to become stopped or unsealed.

(2) Fresh air inlets must be used, and these under certain conditions may become a source of danger to occupiers and others.

(3) They always contain several gallons of stagnant sewage.

(4) They necessitate the erection of ventilating shafts in streets near houses.

With respect to (1), the sanitary inspector frequently finds that the source of a complaint of offensive drains is due to the interceptor being blocked. Drains may remain in this condition for months before the cause of the trouble is discovered by the occupier. Generally, what happens in these cases is that through some object gaining entrance to the trap it is gradually choked, perhaps not entirely, but nearly so, the pressure of sewage being sufficient to force a small trickle through the trap or leaky joints, so that before the drain is actually stopped, and sewage appears at the lowest gulley, a considerable time has elapsed. The inhabitants have been conscious from time to time of a bad smell, generally at the fresh air inlet, a defective joint at the gulley or soil pipe, from the inspection chamber cover or under a floor. I have found numbers of drains in this condition, and when covers are removed they are seen to be charged with stagnant, semi-liquid sewage giving off a horrible stench. Then before it can be remedied the whole contents may have to be baled or pumped out, for it is impossible to get at the trap or clearing eye until this is done. I am quite aware that there are many patent devices for removing the plug of the clearing eye without the trouble of emptying the drains, but how many does one find in use? I have seen very few, except at good-class residences. In some districts the by-laws require the provision of a chain attached to the plug and brought up to the underside of the cover, or fixed in some other way. These are undoubtedly very helpful, but here again their use is very limited. It is remarkable what is sometimes found in these blocked interceptors; I have seen sticks, children's hats, stones, glass bottles, fruit and fish tins, brushes, coal, cinders, ashes, and articles of clothing, among other things.

In my district it is an exception to find a well-laid drain stopped. Then with respect to traps becoming unsealed. On p. 362, Moore's "Sanitary Engineering," six ways are given in which the trap may fail in its purpose, the author adding that they (traps) are necessary evils.

I have little personal experience of a properly set trap becoming unsealed, but I have frequently found one fixed in such a manner as to nullify its object, usually by tipping the trap forward, and it is quite conceivable that the desired effect can be defeated in the manner mentioned by the author. I have seen an interceptor of a certain pattern so choked that it withstood a head of over 10 ft. of sewage.

(2) It is generally agreed that a fresh air inlet is a necessary adjunct to a trap. In the majority of cases the inlet is fixed on the front wall of the house or in the forecourt a few feet above ground level. In my opinion they are a snare and a delusion. More often than not the mica flap is damaged, and frequently it has disappeared together with the front of the inlet, and in this condition is worse than useless. Children use them for receptacles for all kinds of things. It may be said that they should not be allowed to remain in this condition; it is easier said than remedied. In the event of the drain becoming stopped or the trap unsealed, they must then become a source of great danger to health.

(3) There is always several gallons of sewage in the trap which is frequently being stirred up, for I think it is safe to say the contents are not wholly displaced at each flush by the incoming sewage; this naturally gives rise to offensive odours.

(4) With respect to the effect of interceptors on the ventilating of sewers, it appears to me to have a very important bearing.

It is generally agreed that thorough ventilation of sewers is very necessary. Under sec. 19, Public Health Act, 1875, we are told it shall be done; notwithstanding this, I believe it is entirely omitted in certain towns—that is to say, it is not provided for by local authorities—but it is fairly safe to assume that the sewers are ventilated in some other way. In my district we have practically no interceptors and no public sewer ventilators, except where there are long lengths of sewers through fields or other open ground.

The district was sewered some thirty years ago, and for some reason, which I am unable to give, traps were omitted from the start, and have been up to the present. I believe in the whole of this time not a single complaint has ever been received of an offensive vent pipe. We have entirely omitted the use of street ventilators; in effect their place is taken by the drain vent shaft on every house.

Over ten years ago I went to East Grinstead imbued, like most other sanitary engineers, with the importance of intercepting house drains. I was surprised to find that their use had been studiously avoided. My professional curiosity was aroused, and I gave a good deal of time and study to the subject. I candidly admit I was somewhat hostile to the idea, and naturally looked for the results I had been taught to expect, but I failed to find them, and now, after over ten years' experience, I feel bound to say my views on the subject have been considerably modified, to say the least. I feel sure our health statistics will compare very favourably with any town similarly situated where interception is enforced. A well-known authority on sanitation once said to me, when discussing this matter, "that towns like mine would have good health whether interception was carried out or not." I replied: "If that is so, why use them?" His reply was a shrug of the shoulders. I have had twenty-five years' experience in sanitary work in widely separated districts where interception is and is not strictly enforced, also where it is omitted, and my conclusions are based upon this experience.

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*Paper presented at a Southern District Meeting of the Institution of Civil Engineers (Great Britain).

In a town where the interceptors are in use the effect of ventilating from the houses vent pipes could be tried by taking out the stoppers from interceptors, and placing them in a fresh air inlet pipe. It would be interesting to know the result. Of course, the piece of sewer experimented with should be temporarily trapped off from the general system.

The Georgia-Harris Viaduct, Vancouver

THE problem of relieving the heavy pressure of traffic on Hastings and Pender streets, two of the busiest thoroughfares in Vancouver, will be solved for some time to come at any rate, by the erection of the Georgia-Harris Viaduct, a structure which will extend from the west end of Harris street in a westerly direction, crossing over an arm of False Creek, the properties of the Canadian Pacific Railway, B. C. Electric Railway, and the Great Northern Railway, until it reaches the present eastern end of Georgia street. Some four years ago an estimate was made for the erection of such a structure at this point, and was finally endorsed by the citizens in January, 1912. In the open competition held a short time after this date, fifteen designs were submitted by a number of widely-known engineers, the first prize being awarded to Mr. C. A. P. Turner, M. Can. Soc. C. E., M. Am. Soc. C. E., of Winnipeg and Vancouver, the inventor and patentee of the "Mushroom" system of reinforced concrete construction.

Mr. Turner submitted two designs. One of these provided for the use of the standard Mushroom type of reinforced concrete throughout, excepting in the arch span over False Creek, while the second and accepted design called for long spans over the C. P. R. yards and consisted of four parallel Warren continuous trusses.

The plans of the viaduct reveal a number of rather unique features in different styles of construction. The total length of the structure is 2,854 feet, its total outside width 66 feet, comprising a central roadway 53 feet wide carrying a double-track for street cars and two 6 ft. 6 in. sidewalks. Provision is made for a short filled approach of 69 feet at the Harris street end. Commencing from this point there are twelve spans of the Mushroom type, ranging from 25 ft. to 30 ft. 6 in. The 400-foot section immediately to the west forms an interesting type of design for long spans in reinforced concrete. At that point the 123-foot arch over False Creek is cantilevered out from each pier, and the west side of the arch is continued as a reinforced concrete continuous girder, with spans varying from 50 to 63 feet, the length of the spans having been determined by the position of the tracks leading to the Great Eastern Railway freight yards. These girders are also cantilevered out from the end support, thus materially reducing the cost of the spans. The arch consists of three ribs, 25 ft. 3 in. on centres, and is reinforced with structural members sufficiently strong to carry the dead load of the span, thus permitting rapid erection without interfering with navigation on False Creek.

From the end of the continuous girders the Standard Mushroom type is again used for fourteen spans, ranging from 26 feet to 40 feet. The succeeding 150-foot section of the structure consists of three parallel reinforced concrete girders, with two spans of 60 feet approximately, and cantilevered out from each end support. These spans cross over the tracks leading to the British Columbia Electric Railway Company's local freight yards. For the next 260-foot section there are seven standard Mushroom spans varying from 37 ft. 9 in. to 43 ft. 6 in. The latter is the largest Mushroom span on the structure and is about 85 per cent. of the length of the other existing spans using this type of construction.

With the exception of the filled approach at the western end, the remaining portion of the viaduct consists of four continuous structural steel Warren trusses, supported by legs with expansion rollers at the base of the supports which is approximately 22 feet below the lower chord of the trusses. The individual members of these trusses are encased in concrete in order to conform with the appearance of the balance of the viaduct, as well as to protect the structural members from weathering and locomotive gases.

At the eastern end, the trusses are cantilevered out from the support and terminate into reinforced concrete girders, which rest on a specially designed bracket on the column supports of the western end of the Mushrooms spans. The entire deck of the structure is reinforced concrete with ornamental cast stone handrailing and lamp standards of modified Corinthian columns in the same material, there being 55 lamp standards altogether, spaced 100 feet apart. Steel trolley poles will be erected between the lamp standards every 100 feet where practicable.

Tenders for the Georgia-Harris viaduct were called for on January 30th of this year, and the contract awarded a short time later to Messrs. J. McDiarmid & Company, of Winnipeg and Vancouver. Actual work commenced on April 3rd last, and has been progressing steadily since that date. The foundations have practically all been placed, and at the present time the contractors are making rapid headway with the construction of the deck.

The foundations in False Creek were placed by sinking reinforced concrete caissons, 12 ft. in diameter and 40 ft. high. The caissons consisted of an 8-inch concrete shell with a steel cutting edge at the bottom. The method of placing these piers comprised the building of the form of the concrete shell for the caissons on top of the steel shoe. This was thrown into place by means of a derrick and stayed in a vertical position with the aid of guide piles previously driven. The concrete was then poured. After setting sufficiently the forms were removed, and excavation was commenced, an orange peel bucket being used for the latter operation. The structural steel for the trusses over the C. P. R. tracks is now in transit from the Dominion Bridge Company's works at Montreal, and it is fully expected that work on the entire structure will be completed well within the time limit for the contract, which expires on June 1, 1915.

The work is being executed under the direct supervision of Mr. A. P. Hueckel, district engineer for Mr. C. A. P. Turner, the consulting engineer, and Mr. F. L. Fellowes, supervising city engineer of Vancouver. Mr. T. Borgford, local manager for Messrs. J. McDiarmid & Company, has charge of the actual construction. The total cost of the viaduct has been estimated at approximately $500,000.

Georgia-Harris Viaduct, Vancouver. Sinking caisson into position in False Creek.

Every draftsman has occasion at one time or another to color a drawing or a whiteprint. The use of colored inks is unsatisfactory; cross-hatching in colors obscures the details and is slow, while water colors have the disadvantage of slowness besides being difficult to apply evenly. A quick and satisfactory method of coloring involves the use of ordinary wax crayons and gasoline, says the Engineering and Mining Journal. Crayon of the color desired is applied and then rubbed with a piece of cloth, wet with gasoline, until the color is even, and extended to the limits desired. If it overruns the lines, it can be erased with a pencil eraser. Some colors, particularly the yellows, purples, greens and light blues, produce much better results than others. It is probable that the gasoline dissolves the wax from the crayon, leaving the pigment as an impalpable powder, which, when rubbed over the paper, colors it uniformly. The method is applicable with equal success to egg-shell and smooth drawing papers and to white prints on both paper and cloth.

At the present time there is $83,000,000 of work going on in connection with the subway lines of the dual system of rapid transit in New York, with an average daily force of 17,000 men. It is estimated that the city-owned lines will, when completed, cost about $200,000,000. There is about two-fifths of the value of this work already under contract. Of the remainder, to cost $117,000,000, it is expected that more than one-half will be under contract before the end of the year, so that by that time, nine months after the signing of the dual system operating contracts, actual construction work will be in progress on three-quarters of the city-owned lines.

The Design of Concrete Abutments Without Wing Walls for Deck Girders

By C. M. Luther*

IN designing concrete abutments for railway bridges, there are certain occasions when it is permissible to let the earth fall in front of the abutment: in other words, certain conditions justify construction of abutments without wing-walls. When such is the case, care must be taken to see that the earth does not encroach on the bridge seat.

Assuming that the bridge seat is at some distance above the surface of the ground, the following points enter into the design as important factors, in so far as the question of keeping the earth away from the bridge seat is concerned:

1. Rate of slope of the backfill.
2. Width of the ballast wall proper, and rate of frost batter on back of same.
3. Distance D from the bridge seat to the top of the ballast wall.

In addition to these, the length of the bridge seat as compared with the width of the subgrade or roadbed, and the distance from the subgrade to the top of the ballast wall, also require consideration, the discussion of which, however, will be omitted, as the difficulty arising from these adjusts itself to the circumstances in many cases.

A rock backfill presents but little trouble in this respect as compared with dry, loose earth backfill. This is equivalent to saying that, other factors being the same, the steeper the slope of the backfill, the easier would the solution of the problem be. This can readily be seen by a glnace at the accompanying figures, and does not need any further explanation.

The width of the ballast wall is generally taken from 1 ft. 6 in. to 2 ft. 6 in. for ordinary abutments; and there are conditions which forbid the designer to take excessive width. The frost batter on the back of the ballast wall can profitably be made light in a ments for through girders, as in that case the distance from bridge seat to ballast wall is comparatively small. Most engineers prefer to have the width of the horizontal section of the ballast wall on the plane of the bridge seat not less than one-half the distance from

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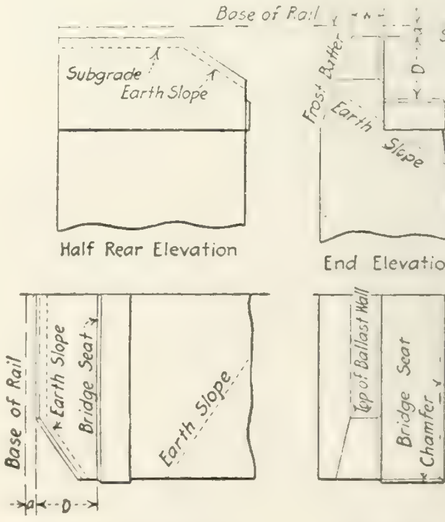


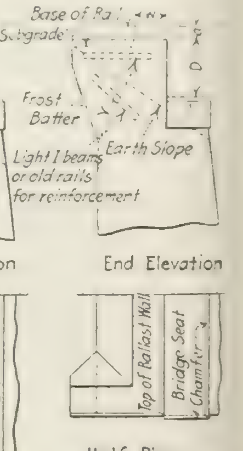
Half Rear Elevation

End Elevation

Half Front Elevation

Half Plan

FIG. 1



End Elevation

Half Plan

FIG. 2

base of rail to bridge seat. This may be stated by the formula $W + Db = \frac{D + a}{2}$ in which (see Fig. 1)

W = Width of the ballast wall on top;
D = Distance from the bridge seat to the top of the ballast wall;
a = Distance from the top of the ballast wall to the base of rail;
b = Rate of the frost batter per unit of height.

If this practice is endorsed, ballast walls of abutments for deep deck plate-girders must necessarily be given greater width on top and heavier frost batter on back. The wider the ballast wall and the heavier its frost batter, the further would the earth fall from the bridge seat.

When D is small the problem is comparatively simple: and in fact in many cases a ballast wall of ordinary width with an average frost batter, coupled with slight changes from an ordinary design, is enough to prevent the earth from running on to the bridge seat. This is particularly true in the case of abutment designed for through plate-girders, in which D seldom exceeds 4 ft. Fig. 1 illustrates an abutment of this class. It must be noticed that for through bridges the ballast wall proper is shorter than the bridge seat; so that the earth will start to fall along the side of the abutment at a considerably lower point than it would have done were the ballast wall proper longer than or equal to the bridge seat. Therefore, the excess of the length of the bridge seat over that of the ballast wall proper will of necessity, help the matter considerably.

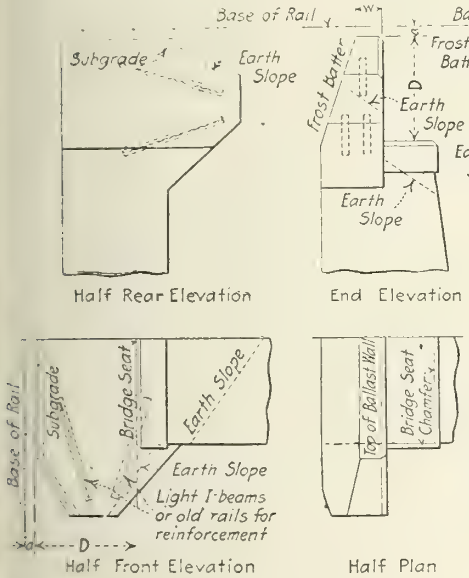


FIG. 3

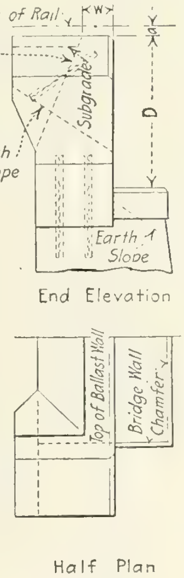


FIG. 4

In the case of an abutment for short deck plate-girders, in which D is same as in Fig. 1 but the bridge seat, instead of being longer than the ballast wall, is practically of same length, to attain the desired object the ballast wall is turned at its ends, parallel to the centre line of the track, with a battered surface on its back (Fig. 2). In this case the earth begins to fall along the side of the abutment from the level of the subgrade, but at a considerable distance back from the face of the ballast wall.

In cases for long deck plate-girders, however, in which D varies from 7 ft. to 12 ft. or even more, it is difficult to keep the backfill from encroaching on the bridge seat in ordinary abutments, unless short wing walls are provided. Fig. 3 shows an abutment without wing walls, intended for deck plate-girders, suitable for cases in which D is about 7 ft. or under. To attain the point in view, the ballast wall proper is extended, following the slope of the backfill, and retaining the frost batter of the ballast wall as well, forming a short cantilever. For lack of better terms, we will call these extensions lugs. The earth slopes down along the back and to the end of the lug; then turns along its side at some distance below the subgrade, which is determined by the length of the lug, and the slope of the backfill. These lugs are reinforced with light I-beams or old rails. This type of abutment has been extensively used by the Canadian Northern Railway on their Eastern Lines and has been found very satisfactory.

For same slope of the backfill, the greater the distance D, the longer will the lugs be; so that higher values for D call for excessively long lugs, which are, of course, objectionable. But by modifying the ballast well, or the lug or both, as the case may require, the matter can be considerably simplified. Fig. 4 shows a design in which D is about 10 ft. In this case the ballast wall is turned at its end, parallel to the centre line of the track, with a battered surface on the back, and a short lug attached on the front.

Fig. 5 shows another type with some modifications, having nearly 13 ft. for D. The ballast wall has been turned and battered on the back, as in the preceding case, while part of the front of the turned portion is vertical. The lug instead of starting from the top of the ballast wall, starts at some distance below, depending upon the slope of the backfill, length of the turned portion of the ballast wall and the frost batter of the lug itself.

In these types the ballast wall proper is taken equal to the width of the subgrade, or roadbed. These cases have been cited to serve as simple examples. Special cases must be given special consideration. It is believed that these abutments can profitably be adopted when conditions warrant having the earth partly cover the breast of the substructure. There is, undoubtedly, considerable saving in concrete, in this design, which would not be feasible where short wings are used.

A design is sometimes used similar to that shown in Fig. 4, except that it has little curtain walls on the sides of the bridge seat, extending from the face of the ballast wall toward the breast of the abutment, and fol-

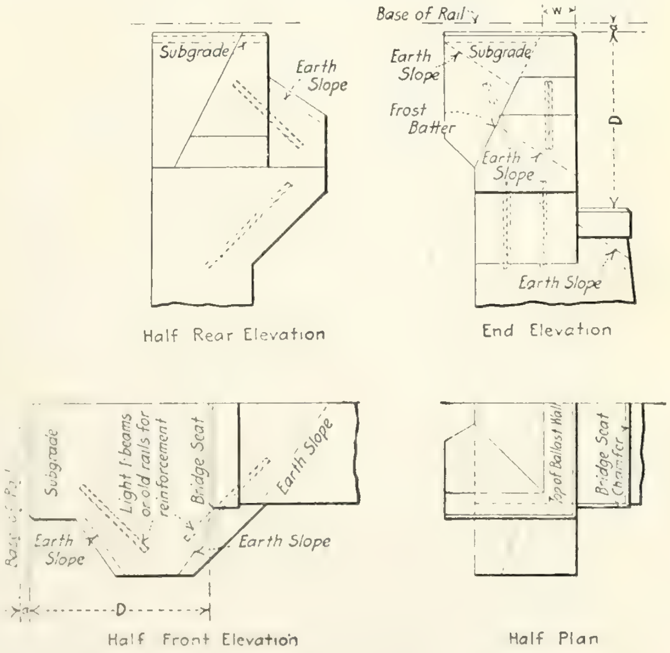


FIG. 5

lowing the earth slope. This design, however, calls for unnecessarily long bridge seat, unless the curtain walls are properly reinforced and then projected beyond the sides of the bridge seat. The vertical surface on the bridge seat may also be objected to, on the ground that undesirable material may accumulate between the girder and the adjacent wall, especially when the bridge seat is comparatively short. Furthermore, the girders during erection may hit the thin curtain walls and demolish them.—Engineering News.

Design of Steel Mill Buildings—Part II[*]

Practical Considerations Influencing Type and Proportions of Members Commercial Features, Detailing, Architecture, Drawings and Specifications

By R. Fleming[†]

For steel members in compression there are a number of column formulae in common use. The straight formula, $S = 16{,}000 - 70\ l/r$, is recommended, in which S is the allowable stress per square inch, l, the effective length of member in inches, and r, least radius of gyration of the member in inches. The maximum value of S is 14,000.

Wind Pressure

It is with considerable hesitation that the writer approaches this much-discussed subject. Much that is written on wind pressure and the stresses resulting therefrom is based on assumptions that are too uncertain to warrant the accuracy and amount of work involved in their treatment. There are many steel mill buildings that have been standing for the last 15 or 20 years in good condition, many members of which, if calculated for wind according to some of the theories advanced, would be stressed beyond their ultimate strength. This is especially true in the case of side girts supporting metal covering. If they are considered as beams, the calculated stresses for bending are far beyond allowable limits; if considered as suspension rods between columns the connections are entirely inadequate.

In an ordinary mill building the wind does not play the important part that it does in a high office building, but the designer should know as far as can be ascertained to just what extent it affects the structure and make assumptions accordingly. The wind as a part of the roof load has been mentioned under "Roof Loads." We have yet to dispose of the problem of wind on the sides of a building.

The general method is to consider the wind stresses carried to the foundations transversely by each separate bent of the building. The Chicago building law, which is one of the latest and best of our building codes, has the provision: "All buildings shall be designed to resist a horizontal wind pressure of 20 lb. per square foot for every square foot of exposed surfaces. For stresses produced by wind forces combined with those from live and dead loads, the unit stress may be increased 50 per cent. over those given above; but the section shall not be less than required if wind forces be neglected."

With the wind blowing horizontally, a load of 20 lb. per square foot on the side of the building and on the vertical projection of the roof surface is thought ample. The ends of the columns are considered fixed at the base, with the point of contraflexture midway between the base and the foot of the kneebrace, or, in the absence of kneebraces, midway between the base and the gusset plate connecting the truss to the column. One-half the wind load on the surface between the foot of the kneebrace or gusset plate and the column base will be carried directly by the column to the foundation and need not be considered further. The remaining side pressure is concentrated at the foot of the kneebrace or gusset plate and the panel points of the roof truss. The bases of the columns are each assumed to take one-half of the horizontal reaction. A stress diagram should be made based on these assumptions.

The stresses due to the dead and snow load can easily be found either by taking a proportion of the stresses already found due to the combined dead, snow, and wind load on the roof or by making a new stress diagram. Comparing the two sets of stresses in accordance with the Chicago building law it will readily be seen what unit stresses are to be used in proportioning the members. In no case, however, should the sectional area of any member be less than that required by the combined dead, snow, and wind load mentioned under "Roof Loads" using the working stresses given under "Unit Stresses." In addition to direct stresses, the columns take bending from the wind load. The maximum bending occurs in the leeward column at the foot of the kneebrace and at the column base, being equal to one-half the distance from the foot of the kneebrace or the gusset plate to the ground, multiplied by the horizontal reaction at the point of contraflexure. From the bending moment the flange stresses in the columns are found. As these flange stresses are due to wind, the higher unit stresses can be used in determining the flange area required. Making comparisons in the manner mentioned above it can be determined whether the sectional area of the column required by the direct stress should be increased.

A weak point in the above method is in the assumption of the point of contraflexure. In actual practice the bases of columns are seldom fixed sufficiently to warrant such an assumption. Again the assumption that the horizontal reaction is equally divided between the two columns may or may not be true. A compensation for these errors is found in the fact that a wind load of 20 lb. per square foot for areas near the ground is excessive.

Another method is to consider the columns as beams uniformly loaded and the reactions at their tops taken, by means of a system of bracing in the plane of the lower chords of the roof trusses, to the ends of the building and thence to the ground by diagonal bracing in the plane of the ends. This method is well adapted for buildings where the bottom chord is a considerable distance above the floor, provided the building is not so long that it requires expansion joints and that there are no openings in the ends to interfere with diagonal bracing.

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[*] Second and concluding portion of article reproduced by courtesy of The Engineering Record. Part 1 appeared in our issue of November 5.

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In proportioning the members a copy of some standard general specifications for steel work will call attention to many points which might otherwise be passed by. Thus, the length of compression members shall not exceed 125 times, and those used for wind and lateral bracing 150 times, their least radius of gyration; material less than ¼-in. thick, except for fillers, shall not be used, and a number of similar requirements will be found.

The designer of a structure may not make the working drawings, but he should be competent to do so. Unless he has had actual experience in detailing it is probable his design will have more or less serious defects. For this reason one of our largest structural steel companies makes it a rule that engineers before entering their designing department should have not less than three years experience making shop drawings.

A common error is to so proportion a girder that a sufficient number of rivets cannot be used to develop the flange stresses. Crane girders have been designed with the flanges of 6 x 4-in. angles (4-in. legs vertical) and cover plates, ample for compression or tension with a web sufficiently thick for shearing stresses. When it comes to be detailed it is found impossible to get enough rivets in the 4-in. leg of the angles to transmit the stresses from the flanges into the web plate. A thicker web plate to increase the bearing values of rivets, or, better still, 6 x 6-in. angles allowing a double row of rivets might have obviated the difficulty.

Commercial Features

In addition to the purely technical there are also the commercial features of structural engineering. Some of these it is well for the designer to know. For instance, the hand-books of the steel companies generally classify the sections as standard or special. The latter, on account of the smaller demand, are rolled less frequently, and hence it is often difficult to obtain them in a reasonable length of time. When the demands for any given size have accumulated to a certain tonnage it is included in the schedule of rollings. A whole structure has been held up indefinitely waiting for some pieces of an odd size. As a rule, the fewer the sizes used the more prompt will be the delivery.

Three or four years ago the engineer of a building near Philadelphia used a ship channel that he had found listed in an old hand-book for the tracks of an extensive system of suspended trolleys. After the contract was placed it was found these channels had not been rolled for five years. There was not enough tonnage to warrant a special rolling; besides, the rills were out of order. With considerable annoyance the engineer changed his tracks and track supports.

Mere ingenuity or originality of design is not enough to warrant a departure from standard types of trusses, girders, or other parts unless accompanied by a reduction of cost. Precedents need not be followed blindly, but "indifferent originality is more expensive and less creditable than good imitation, and the success of the engineer is directly proportional to the success of his work and to the lowness of its cost."

The pitch of the roof will largely determine the outline of the roof truss. The Fink type of truss is the one most commonly used for roofs of 5 or 6-in. pitch. The Warren and Pratt trusses are well adapted to a roof nearly flat. The factors determining the most economic spacing of wall-bearing roof trusses are the trusses themselves, the bracing, and the purlins. If the steel columns, side girts, or crane girders are used, they also are to be considered together with the cost of foundation. It is to be noted that the net cost per pound of purlins is much less than that of columns and trusses.

The theoretical economic spacing of roof trusses is about one-quarter the span, but the actual spacing may be governed entirely by conditions peculiar to the structure under consideration. If the covering or sheathing rests on purlins a spacing of about 16 ft. is commonly used up to spans of 65 ft.; beyond that the spacing may be one-quarter the span. Where plank sheathing rests directly on the trusses the spacing may be 8 to 10 ft. for 2-in. and 12 to 14 ft. for 3-in. tongue-and-groove plank. This method can often be used to advantage for spans up to 40 or 50 ft. As there are no purlins in this case, there should be a system of bracing to hold the trusses in place.

If spans are of unusual length or roof loads are very heavy it may be found economical to use jack rafters resting on latticed or beam girders framed into the roof trusses. Purlins can be used on top of the jack rafters or wood sheathing can extend from rafter to ratfer.

Wooden purlins used with steel trusses are often made to act as struts for a system of diagonal bracing, but the practice is not to be commended. The struts as well as the diagonals should be of steel.

Roof trusses are mostly made up of angles, sometimes entirely so. Flat bars should not be used for tension members. They are easily bent in handling and the stress coming upon them is often not enough to straightem them. If there are loads between panel points producing a bending stress sufficient to warrant it, the top chord should be made of two channels or two angles and a stem plate. The stem plate should not be too thin for its width or it will buckle along its lower edge when fully loaded. The bottom chord may be of similar construction where bending stresses occur from various causes. It is a good plan to detail the lower chord channels about 1 in. apart so that ¾ or ⅞-in. bolts can be run between them and attachments easily made. Purlins should be made of single rolled shapes—channels, beams or angles. Trussed purlins should not be used.

Columns

The plate and four-angle type of column with cover plates when necessary is mostly used in mill buildings on account of its low cost of fabrication and the ease with which trusses, girts, or beams can be connected to it. For interior columns, where the loads and unsupported distances of columns are not great, the steel section known as Carnegie mine timber can be used to advantage. The H columns rolled by the Bethlehem Steel Company have been received with favor, but are used more in office buildings than in mill buildings. The box section of columns generally made up of two channels latticed is not so well adapted to mill buildings on account of its higher cost and the greater difficulty of painting and inspection. Connections are not so easily made, and it is likely to become a receptacle of dust and moisture. Closed-box sections should not be used at all.

The exterior columns should be proportioned for (1) direct stress due to roof, floor, crane, or other loads; (2) bending due to wind on the sides of the building; and (3) stress due to eccentric loads. For columns supporting crane girders, the flange of the column under the girder is usually considered as carrying the total crane load together with its share of roof load and any floor load that may come upon it. When this load is large, or the unsupported distance of column is great, a channel or plate can be used on the backs of the angles under the crane girder. Of course, bending stresses from the wind or from eccentric loads can be lessened by increasing the width of the columns. When the columns are assumed to have their lower ends fixed, care should be taken that the bases are firmly anchored to the foundation by set bolts.

Kneebacks

Attention is here called to that important member, the kneebrace. While it should be of abundant strength to take the stresses coming upon it, it is folly to make the kneebrace "good and strong" unless there is provision to take the thrust or tension at each end. If the trusses and columns have been figured for uniform load only, the stresses due to the kneebraces should be determined and sections increased where necessary. Similar calculations should be made when travelling cranes require gusset plates to be used in place of kneebraces.

The sight is not altogether unfamiliar of a kneebrace of liberal proportions fastened at one end with three or four rivets or bolts to a latticed column and fastened at the other end to the bottom chord of a roof truss having at that point a diagonal member consisting of a single light angle. Such connections are able to develop the strength of only a very light kneebrace. The lacings in the columns should be replaced by a plate, the number of rivets in the connections should be increased and the single-angle diagonal in the truss should be made of two angles. In a cement mill near Allentown, Pa., are some kneebraces of 6 x 6-in. angles fastened by only a single bolt at each end.

Beams and Girders

The safe loads that can be carried by the various sizes of rolled beams are given in the Carnegie and other handbooks. Care must be taken that the tabular safe loads are reduced when the top flanges are without lateral support for more than 20 times their width. In certain cases, for instance where a ceiling is supported by beams, the limits for deflection should not be exceeded. The comparative cost of rolled beams and plate girders should be considered when there is a choice between them. Preference is generally given to rolled beams where they can be used. In proportioning plate girders their depth should be taken as the distance between the centre of gravity lines of the flanges, with one-eighth of the web area allowed as part of the area of each flange. A more nearly correct way is to design plate girders by their moments of inertia.

For lateral stiffness the top flange of a crane girder should not be less in width than 1/20, or 1/25 at the most, of its span. A channel riveted to the top-flange angles gives stiffness and adds to the flange area. If the rolled channels are not of sufficient width a built channel of a plate and two angles answers the same purpose. Addditional area if required can be made up of cover plates. If runway girders are riveted to the sides of columns it will be difficult to secure a proper alignment. They should rest either on the tops of columns or columns should be stepped off to receive them. For light cranes they are sometimes carried on brackets attached to the columns. Crane rails are sometimes riveted to the top flanges of girders, but this allows no alignment. The rails should be fastened by hook bolts or by adjustable clamps and bolts.

An end greatly desired in all steel structures is that they should be well braced. No general rules can be given for bracing. It is not entirely a matter of calculation. Experience, common sense, and a comprehensive grasp of the situation are needed. In bracing for wind it should not be forgotten that the wind blows against the ends of a building as well as against the sides. Two years ago a pier shed along the New Jersey coast had to be braced longitudinally to keep the ends from blowing in. The designer had made no provision whatever for wind pressure against the ends of the building. A certain amount of bracing is needed for erection purposes. Better reduce the main members themselves than economize in bracing. A building seldom fails from lack of material in the main members, although these are sometimes greatly skimped.

Architectural Features and Details

Ruskin gave the advice, "Do not construct ornamentation, but ornament your construction." A mill building is designed, first of all, for utility, and the architectural features are usually a secondary matter. But this is no reason why a building should be an architectural monstrosity. A slight expense will oftentimes change a structure that is unsightly to one that will at least not be an eyesore. In the future there will be greater economic values attached to symmetry and beauty than at present.

The part of the detailer in making or marring a structure can hardly be overestimated. Some of the buildings of the Gary plant of the United States Steel Corporation are 1,400 ft. long and more than 100 ft. high. The engineer under whose supervision the designs were made writes: "While the assumptions of loads and their application to structures of this class may not always have been entirely correct, I am satisfied that we have had more trouble and failures due to the lack of proper consideration of the details of this structure than to improper assumption of their loading."

On receipt of the design drawings the detailer should examine them carefully to ascertain if he has all the necessary information. As he proceeds with the working drawings he should take up with the designer any points that are not entirely clear. He had better ask six foolish questions than omit an important question that should be answered. At the same time he should report any faults he may discover; for instance, swinging sash that if open would be struck by a traveling crane in passing.

As soon as possible a plan should be prepared for the purchaser, showing the size and location of column bases and anchor bolts. This drawing is generally called a " foundation plan"; but this name is a misnomer, as it usually shows only the location of steelwork. The loads coming upon the foundations from the steel columns should be given. The drawing now gives enough information for the foundation to be designed by others, as it is seldom that the structural engineer is called upon to do this. A crane clearance diagram, if there are traveling cranes, should also be prepared at an early date and sent to the purchaser for the use of the crane maker.

Details should be designed for strength and economy, in accordance with shipping facilities, cost of transportation and ease of erection. Connections producing secondary stresses are sometimes used when, by a little ingenuity, they could be avoided. When there is a direct vertical load on a plate girder, such as the wheel load from a traveling crane, sufficient rivets should be provided throughout the top flange of the girder to take the resultant of the vertical load distributed over a given length and the difference in flange stresses. Economy will be gained by having as many duplicate parts as possible. Close fits are expensive, so also is needless refinement in workmanship.

Shipping Dimensions

The maximum dimensions of a piece that can be shipped on a car will sometimes be needed. The railroads charge for freight by the pound in carload lots, with a higher rate for less than full cars. There is a minimum weight for a carload lot. If this was 30,000 lb. and the car was loaded with 20,000 lb., the rate per pound would prevail. The lesser loading, from the nature of the pieces shipped, can not always be avoided, but the detailer can often lessen or increase the amount that can be loaded on a car by the location of his splices and his decisions regarding field and shop riveting.

The steamship companies have, for export work, a rate per cubic foot of space occupied and another rate per pound. The rate which will bring them the most money prevails. This is liable to be the rate per cubic foot. The remedy is for the designer to detail his work to be shipped "knocked down" as much as possible. An extra rate is charged if single pieces exceed certain lengths or weights. Some trusses for a light highway bridge were once shipped from an inland shop to the steamer riveted together. The steamer charges for freight were more than one-half the price received for the bridge.

Erection and Expansion Joints

Ease of erection should be borne in mind by the detailer. While it may lessen freight charges to ship a truss in many pieces, it will increase the cost of field riveting in erection. A study should be made to determine which had better be done. Every erector of steelwork who has been long in the business will recall details that have unnecessarily added hundreds of dollars to his expense account. Beams framed between girders striking stiffeners, girders and framed beams striking rivet heads in columns, insufficient clearances elsewhere, and too close fits are common difficulties in erection.

In continuous structures more than 300 ft. long expansion and contraction due to changes in temperature must be considered. A few years ago an outdoor crane runway in Ohio was built with each girder bolted to its neighbor for the entire length of 1,500 ft. The first change of season played havoc with that runway and it had to be altered at considerable expense. A mill building is much more flexible in this respect than a bridge, and for the average mill building of medium size no provision need be made. Expansion in the direction of the width of a building will take care of itself; it is unusual lengths that need be considered.

If preliminary drawings only are wanted to give the prospective customer an idea of his building, a great deal of information can be omitted that is necessary on the finished design. It is a wise plan, however, to make even the preliminary drawings as full and complete as time and the circumstances will warrant. After a contract is taken the design drawings should be carefully checked and such additional information added as will enable the drawing room to make its working drawings expeditiously and with certainty as to the intent of the design. The revised design should be sent to the purchaser for his approval. All dimensions, distances and sizes of materials should be shown on the drawing. Descriptive matter properly belongs to the specifications, though notes on drawings should be freely used even if their purport is repeated in the specifications.

Checking Drawings

A careful check should be made by the designer after the drawing is entirely finished. Every discrepancy found and corrected will save time and trouble in correspondence later. It is annoying in laying out the work to find the distances between two fixed points given differently in different places on the design. Another common annoyance is to find that the sum of several intermediate distances does not equal the figure given for the total distance. Sometimes a necessary distance or angle is omitted.

All angles and all sides should be given in the survey of a plot of ground. Right angles should be given as 90 deg. and not left to be assumed by the detailer. A common cause of annoyance is to find that the sides and angles of the survey do not check with each other when a trigonometrical calculation is made. This can be avoided by the man who makes the survey checking his work before it leaves his hands. The points of the compass should be shown in order to refer easily to any side or end.

A cross-section should be taken through a definite line on the plan and so marked. "Cross-section on line A-A" means much more than "Cross-section through machine shop." As many sections as are necessary to make clear the intent of the design should be shown.

The location of doors and windows and side and end bracing should be shown on the side and end views. The plan should indicate clearly the roof bracing. The bracing in the planes of top and bottom chords can be shown on one plan by using full lines for one and broken lines for the other. Angles with unequal legs should be marked so that there is no doubt as to which leg is vertical and which outstanding.

Loads and stresses throughout, maximum bending moments and maximum shears in all girders, and in beams used as crane girders, should be given. It should be stated whether stresses are given in thousands of pounds or in tons. The omission of this once caused some trusses to be detailed for tons when the stresses were given in thousands of pounds. The detailer was a new man and had been accustomed to stresses given in tons; the designer had always done his thinking in thousands of pounds. Stresses are generally given in thousands of pounds with the + sign denoting a tensile stress and the — sign a compressive stress.

Avoid Ambiguity

An essential in the design drawings, in fact in all drawings, is clearness. On a certain design, underneath the diagram of crane wheels, was the notation "Maximum wheel load, 30,000 lb." with an arrow drawn to each wheel. This was a cause of confusion because it was not known whether the 30,000 lb. was the load on each wheel or on both wheels. The designer intended "Maximum load on each wheel, 30,000 lb," and it should have been so stated. On the cross-section of another design below the column base was written "Two 1¼-in. anchor bolts 4 ft. long," with an arrow drawn to each of two anchor bolts shown in elevation. It was not certain whether two or four anchor bolts were wanted for the column. A repetition of the note on each elevation would have left no cause for questioning the meaning of the legend.

Abbreviations should be used very sparingly. It should be borne in mind that the design drawings pass into the hands of non-technical men. The notation "No. 20 G.C.S. covering" many mean No. 20 galvanized corrugated steel covering and "Pl. G." may mean plate girder to the man who makes the drawings, but to some that are unfamiliar with his work they are meaningless. The force of an office in Philadelphia spent a good part of the forenoon questioning the meaning of the notation "D. & M. plank" on a drawing which had been received in the morning's mail. At noon the designer came along and gave the information that dressed and matched plank was intended.

Specifications

Clearness is an essential quality in specifications as well as on drawings. They should be so written that the structural-steel contractor should be able to tell from them just what his work includes. There should be a clear-cut division between his work and that of other contractors. Stair work, cast-iron door sills, steel sash and doors, gaspipe railing and similar work should be so described that they can be bid upon separately if desired. The structural-steel contractor should furnish all bolts or rivets connecting steelwork with steel, but should not be called upon to furnish bolts for connecting the work of other trades to steel. Bolts for fastening woodwork belong to the carpenter, mason's anchors should be furnished by the mason.

What are known as "blanket clauses" should not be used when writing specifications for steelwork. Architects are great sinners in this respect. These clauses are generally due to lack of study on the part of the writer in finding out just what is required and are inserted to provide, at the expense of the contractor, for any contingency that may arise. Nothing is gained by this method, for the bidder adds enough to his bid to cover all uncertain meanings of the specifications and the purchaser pays the bill. Occasionally the bidder is caught napping and this renders him even more cautious afterward.

The specifications for one of the West point buildings called for the steel contractor to furnish "all lintels over openings as required." Under this clause he was made to furnish several tons of lintels over openings for heating and ventilating pipes. While the heating and ventilating plans did show openings, there were no lintels called for, neither were they shown on any steel plan. Hence they were not included in the estimate upon which the bid was based.

It is not necessary to repeat in the specification the dimensions, sizes, and weights that are shown on the drawings. In brief, the specifications for steelwork should cover (1) an introductory section indicating the scope of the work and referring to the drawings by number; (2) the quality of the material and the tests to be made; (3) the workmanship, shearing and bearing values for rivets and bolts, whether field connections are bolted or riveted and who furnishes and sets anchor bolts; (4) the approval of working drawings; (5) inspection; (6) the erection of the steelwork; (7) painting, both in shop and after erection; (8) any special requirements.

If there are no general specifications, the definition of party of the first part and party of the second part, the provision for settlement of disputes that may arise, the terms of payment, and similar matters of a legal nature should be embodied in the steel specifications.

Foundations

The most important part of a building is its foundation. If this is not stable the whole building is affected. The inquiry for a prospective mill building generally specifies "to be built upon foundations furnished by the owners," and the structural engineer feels relieved that the responsibility for the design of the foundation does not rest upon him. At the same time, if trouble ever came from the foundation the probability is he would be put on the defensive to show that the steelwork was not at fault.

For the ordinary mill building the loads on the columns are comparatively small and the building is on firm ground. This explains why so many foundations proportioned in a haphazard way answer their purpose. There are cases, however, where this careless method will not answer and trained judgment as well as engineering skill will be required. The difficulty is not to provide unyielding foundations on a compressible soil, but to provide foundations that will settle uniformly throughout the building. When the loads are large there will be some settlement, and if this is much more in some parts of the building than in others there may be serious trouble.

Knowing the bearing value of the soil and the loads to be carried, it would be a simple matter of division to find the required area of footing if the entire load was a dead load or if the live load bore the same ratio to the dead load in all columns. But the live loads are intermittent and constantly changing, while the proportion of the live to the dead loads is different for the various columns. In the design of the modern high office building this is a serious problem. While in a lesser degree the problem enters into mill buildings, it often needs be considered. This is the case in factory or other buildings where the walls are carried by the exterior columns. The dead load forms a large percentage of the total load on these columns, but the interior columns carry mostly a live load. In a machine shop with a center aisle served by a traveling crane with a gallery or two on each side, the percentage of live load on the interior columns is much greater than on the wall columns. Schneider's specifications on this subject are:

"The live loads on foundations shall be assumed to be the same as for the footings of columns. The areas of the bases of the foundations shall be proportioned for the dead load only. That foundation which receives the largest ratio of live to dead load shall be selected and proportioned for the combined dead and live loads. The dead load on this foundation shall be divided by the area thus found, and the reduced pressure per square foot shall be the permissible working pressure to be used for the dead load of all foundations."

The writer prefers in mill building the word "average" to "largest" in "that foundation which receives the largest ratio of live to dead load." But no definite rules can be given for the proportioning of foundation footings. They must be determined from a knowledge of the local conditions and from experience in that particular line of work. If the engineer has not had this experience he should have his work examined by one competent to pass upon it.

When the column loads together with the bearing capacity of the soil are such as to require large footing areas, grillages of steel beams embedded in concrete are often used. Heavy masonry with deep excavations and excessive steel or cast-iron bases is thus avoided. In proportioning these grillage beams the loading should be considered uniformly distributed over the length on which it is applied, the beams uniformly supported from below over their entire length, and maximum bending to occur at the center of the beam.

Comparative Advantages of Different Types of Roads Crusts[*]

THE subject of Communication No. 4 is a "Technical and Economic Study of the Comparative Advantages of Different Types of Roads." The eight reports sent in differ much as regards the method of dealing with the subject, and some of the reporters have failed to grasp the significance of the word "type." The extent to which a study of particular methods is covered by the titles chosen for other communications and questions suggests that it was intended that Communication No. 4 should be devoted to comparisons of well-defined types rather than to descriptions of particular kinds of paving and discussion of their value. In the following summaries attention is mainly directed to the comparisons properly belonging to the subject in hand, but some notes are also made of other points of interest. The summaries, or rather abstracts, as given by "The Surveyor," are very short, as the arguments put forward cannot conveniently be followed in an abbreviated form, and it is difficult to make useful selections from tables of data.

GERMANY

Mr. Scheuermann, Stadtbauinspektor, Wiesbaden; and Mr. Pietzsch, Finanz-und Baurat, Chemnitz, Saxony

The report begins with an interesting discussion of the properties of different kinds of rock employed for stone paving. Small-stone paving laid in sand on macadam is recommended as much to be preferred to large stone paving on a bed of sand directly on the substructure of the street. Attention is drawn to paving made from fine stone grit mixed with asphalt mastic and tar, the proportion of stone being about 45 to 55 per cent. The material is considered suitable for gradients up to 4½ per cent. In comparing the grouting and mixing methods of preparing bituminous-bound road crusts, the former is stated to be the simpler and cheaper, the latter the more refined and reliable process. Surface tarring is recommended for town streets with light traffic, such as residential streets. For country roads small-stone paving is strongly recommended, representing "the most important advance in the whole practice of road making that has been made since the times of Macadam and of the introduction of the road roller." The use of this kind of paving is being rapidly extended all over Germany. The first cost is a third, or at most a half, that of large-set paving. The first installation of small-stone paving costs about three times as much as the renewal of ordinary metalling, which gives a basis for the comparison of costs. For gradients for not more than 1 in 20, tar-grouted macadam may be used, if the means available do not admit of the use of small-stone paving. The sums expended on surface tarring are at least partly made good—exact observations are not yet available—and surface tarring of ordinary metalled crusts may be recommended for roads with light traffic, especially light motor traffic, when stress is laid on the diminution of dust, in dry and sunny situations, and on gradients not greater than 1 in 20. "Ordinary metalling, as it has hitherto been exclusively used in the country road building practice of Germany, will in future be steadily more and more ousted by small-stone paving and by tarred metal (tar-macadam). On all country roads with small traffic, however, where a dust nuisance does not exist or is not objected to, or where a steep or damp situation does not admit of the use of tarred metal, it will continue to hold its own."

UNITED STATES

J. R. Rablin, Chief Engineer, Metropolitan Park Commission, Boston, U.S.A.

This is a very short report. As regard roads in suburban and country districts, the author makes the following remarkable suggestion: "In view of the fact that the conditions of traffic in suburban and country districts so suddenly changed a few years ago, and are so rapidly increasing along these changed lines, it is a question whether it would not have been advisable, when it was first realized that the old type of water-bound macadam could not withstand the new conditions, or at least whether it is not at present advisable to adopt these types of so-called permanent pavements for these roads." As matters stand, the bituminous-bound road crust, made either by the mixing or the grouting method, is recommended for main trunk highways, and the same kind of paving for small towns and in the more thickly settled country districts. On lateral roads leading into the trunk road in the country districts water-bound macadam or good gravel crusts are suitable, and may with advantage be protected by a carpet or surface treatment. The kind of gravel road referred to is made with specially selected gravel screened to the proper size. On park drives and boulevards it is necessary to have a bituminous-bound surface, and carpeting or surface treatment is usually given to this class of road.

FRANCE

H. Sigault, Ingenieur en Chef des Ponts et Chaussees

This report was written after consultation with the author's colleagues, and it therefore sets forth a considerable body of opinion. The point of traffic intensity at which it becomes necessary to abandon the ordinary water-bound crust depends largely upon circumstances. In one town it has been found desirable to make the change at 816 "colliers," in another not until the traffic amounted to 2,884 "colliers." When the traffic is moderate, and fast automobiles do not preponderate, the traffic limit is usually about 1,000 "colliers." Surface tarring has important advantages, but too much must not be expected of it. The detritus cannot get out of the road, but it is formed nevertheless. "This statement is supported by the fact that when this protecting layer of tarred metal is worn away at any point a pothole is formed at once, which deepens very quickly; it would appear that the detritus which had accumulated under the protecting layer is soon dispersed." The author advocates the continual maintenance of the tarry film, tarring being renewed often enough "to prevent the protective layer from disappearing altogether." Though he points out the ordinary limitations of surface tarring, the author states that good results followed surface tarring of strong roads in order that they might resist the heavy traffic of the beetroot season. The crust, when rendered waterproof, was of sufficient strength, and the practice has been continued for six years, making it unnecessary to resort to paving, which would otherwise have been regarded as inevitable. This is a very interesting point in the study of the comparative values of different types of roads.

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[*] Communication No. 4, Third International Road Congress

As regards bituminous-bound roads, a case is cited in which limestone coated with tar proved more durable than the quartzite which was replacing the water-bound limestone. The author regards the use of stone setts as being possibly to a large extent a temporary expedient, pending better information as to bituminous-bound road crusts. As regards conversion from ordinary metalling to setts, the change is made to meet traffic conditions, only one case, and that exceptional in character, having shown a saving in cost. On the other hand, there is usually a saving in changing from setts to metalling.

THE UNITED KINGDOM

H. T. Wakelam, County Engineer, Middlesex; A. Dryland, County Engineer, Surrey; Col. R. E. Crompton, Consulting Engineer to the Road Board; T. W. A. Hayward, Borough Engineer, Battersea; F. J. Wood, County Engineer, East Sussex.

This is a short report, but it contains important data. A table contributed by Mr. J. A. Brodie, M. Inst. C.E., shows, for seven kinds of paving or road crust, the life in years, the life tonnage per yard width, ton miles per yard, width per penny of cost, and other data. The ton-miles per yard width per penny are: 6-in. setts, 34.0; 4-in. setts, 24.0; 4-in. pitch-macadam, 20.6; softwood, 15.5; 7-in. water-bound macadam, tar-sprayed, 11.4; 7-in. water-bound macadam, 7.6; hardwood, 7.4. The nature of the foundation in each case is not stated, but it may, of course, be assumed that the foundations were all suitable and adequate. Another table shows the "weight" of traffic in tons carried 1 mile for one penny of maintenance cost on water-bound crust and water-bound tarred crusts. The weights are the estimated or arbitrary weights of the Road Board table. The weight carried 1 mile for one penny ranges from 1.4 to 15.1, the average for Norfolk roads being 6.0, and for Warwickshire roads 3.7. The opinions of a number of individual surveyors with respect to different kinds of paving are given in a table. The opinions of road users were also collected by the committee. For heavy haulage, such as that near docks, stone setts are regarded as satisfactory, especially for low speeds. For the transport of the goods at considerable speed from business centres into the surrounding country, the owners of heavy vehicles, such as traction engines and motor wagons, carrying 8 tons on the back axle, do not favor any type of bituminous construction, partly on account of the increased tractive effort required in hot weather. It is not clear from the report what are the types of road crust preferred by drivers of commercial vehicles of moderate weight, such as delivery vans. Drivers of light motor vehicles, motor cyclists, and ordinary cyclists prefer, it is stated, well-made water-bound roads which have been surface tarred. As regards the dividing line at which broken stone road crusts may with advantage be given up in favor of stone setts, it is suggested that, instead of taking as the criterion the maintenance cost per square yard per annum, it might be better to make the change when the cost per traffic ton-mile exceeds a certain figure.

ITALY

P. Cattaneo, Engineer to the Municipality of Milan

(1) Report of M. Columbo, Engineer, Milan

In his consideration of foundations the author points to some disadvantages of the concrete foundation—rigidity, high cost, difficulty of access to the subsoil—and suggests that it might be advantageous to employ large pebbles or quarry stones, the latter being the waste from cut stones. On account of the cost of making bituminous joints in paving, and some difficulties in its application, an alternative, the author suggests, might be found in the use of a mortar made of heavy clay soil mixed with sand and pasted on to the stones with a trowel when they are put in position. Clay swells with moisture, remaining watertight, and the watering which is now always considered necessary in dry weather would keep the joints moist.

(2) Report of C. Corazza, Engineer, Turin

The author of this part of the report describes several kinds of paving. One of these consists of flat stones placed on edge, used with an asphalt binder. The stones are 12 centimetres thick, the joints being filled with "ordinary artificial asphalt as a paste." This paving seems to have given satisfaction. A form of wood paving which was tried three years ago has proved successful. It consists of cylindrical blocks of acacia wood 2 centimetres deep, with the fibre vertical, the spaces between them being filled with asphaltic bitumen. It is proposed to use existing road crusts as the foundation for this kind of paving. The diameter will be limited to 12 centimetres, the bark being stripped from round wood blocks. "The timber may be taken from the roadside acacia trees, which are now practically given away."

(3) Report of F. M. Bellandi, Engineer, Florence

This contribution is devoted to an account of work with tar-macadam, which, it is considered, promises to prove a useful material in Italian towns. There are no comparisons with other kinds of paving, except that surface tarring is stated to give decidedly inferior and less economical results under certain urban conditions. The kind of pavement constructed "has all the qualities as well as the appearance of compressed asphalt without its slipperiness, as long as it is kept properly clean, and it may solve the road building problem and that of general paving in the centre of cities." It is considered that for the maintenance of such a road crust a simple tarring of the carriageway, at a cost of 0.12 lira to 0.15 lira per square metre, is sufficient, "while no other work than good sweeping is required on the side walks and margins."

(4) Report of F. Nigra, Engineer, Turin

The best paving for roads with tramways is stone setts, and it is suggested that its use should be made compulsory between the rails and for 50 centimetres on each side. Generally, stone paving should be provided if the traffic exceeds 2,000 "colliers." Bituminous-bound road crusts may be used for roads 10 metres wide and where the daily traffic does not exceed 400 "colliers," if they are to last about four or five years.

Summing up, Mr. Cattaneo expresses the opinion that granite paving is the best for heavy traffic, and that for roads with a large amount of light traffic surface tarring is suitable. He does not consider that any definite conclusion can be expressed as regards bituminous-bound crusts.

MONACA

Dr. E. Guglielminetti (well known as a Pioneer of Dust Abatement on Roads)

This report is on the economic results of surface tarring. The author states that in Monaco town the chief engineer, Mr. Curti, has found that surface tarring results in an economy of 40 per cent. on roads with light traffic and 25 per cent. on roads with medium light traffic, during a period of ten years. Mr. Bourre, chief road engineer of the town of Nice, has found that the period between renewals is greatly extended, and that "the saving on the cost of maintenance almost compensates for the cost of tarring them." For roads with heavy traffic tarring is desirable, though there are many complaints on account of the formation of black, sticky mud in wet weather. Dr. Guglielminetti concludes that the roads on which tarring is to be done must be selected judiciously, and he points out that for roads with heavy traffic it is necessary to have a strong crust, since if the crust gives way the tar will follow. A metalled road which requires resurfacing every two years or oftener cannot be improved in any useful degree by surface tarring, and bituminous-bound crusts would probably prove suitable for such roads.

RUSSIA

B. S. Kouperstein, Engineer, Chief of Section of the Road from Moscow to Varsovi

This report contains some interesting analyses of costs of different kinds of paving and road crusts. Except in the streets of large towns, Russian roads are built on a layer of sand, usually with an ordinary water-bound surface, but sometimes with a paving of natural or artificial stone, the latter being called "artificial stone" (clinker), and being, it seems, some kind of brick. The author points to the advantages as regard traffic and noise. The clinker or brick road is not noisy, and the traffic effort required upon it is small, but the coefficient of wear is low, and the roads become dusty. Metalled roads are laid on a bed of sand 18 centimetres thick, the stone crust being 7 centimetres thick after rolling. The maintenance of such a road is costly. The results attained depend on the materials used, the stone employed in Russia being often of mixed qualities obtained from the fields, and the limits of size are very wide. The binding material is usually dry screenings, and the author has found it lacking in binding qualities and more of the nature of a packing material. Surface tarring is costly, 47 centimes per square metre in a case cited, excluding labor and the cost of heating the tar. A Portland cement and lime binder mixed with screenings has given good results, the mixture being spread first on the picked road surface and the stone spread over it and rolled until the cement floats to the surface.

The author concludes that the most economical roads are those made with round field stones, but they are not good roads. The clinker (or brick) paving is to be preferred to the water-bound metalled road, chiefly on account of the defects of the latter, as made in Russia, and more generally for roads with heavy traffic. For very heavy traffic it is better than metalled roads of a good class, and for a further range of roads it is practically to be preferred, except when the materials for a metalled road are good and cheap, and the construction better than is usual in Russia. Paving with regularly shaped stone is costly in the Russian Empire, and is only done in a few large towns.

THE NETHERLANDS

Dr. L. R. Wentholt, Engineer of the Waterstaat of the Netherlands

Of the 1,900 kilometres of State roads, 1,200 kilometres are paved with brick. Brick paving has the following advantages: Its maintenance is simple and easily understood; it is free from dust in summer and from mud in winter; it can easily be taken up for pipe laying and so forth; and it provides sufficient foothold for horses. On the other hand, its maintenance expenses are very high; it is not strong enough to carry a very heavy load; and unless the surface is very well maintained it is not a good one for cyclists. After pointing out advantages and disadvantages of stone sett paving, and of gravel and shingle road crusts, the author includes that "there is not much to choose between the advantages of brick roads, gravel roads, and roads built with large setts and shingle, when one weighs the pros and cons of each class of road, and the selection of the type to be adopted in each particular case will entirely depend upon financial considerations." In his final summing up, Dr. Wentholt states that a brick road is, from the financial point of view, to be preferred to a road paved with large setts, and that outside the towns a shingle surface is usually to be preferred to either, except where there is very heavy traffic, such as that in the beetroot district, and in some other cases in which a brick road is preferable. The report contains tables showing, for numerous roads of a large total mileage, the proportion of road surface renewed annually, the annual cost of maintenance, the coefficient of traffic, the number of bicycles, the annual cost in terms of traffic, and the condition of the road.

INTERESTING statistics regarding the new Equitable Building, now under way on the site of the old structure in lower Broadway, New York City, convey in a measure the magnitude of the undertaking. Among other things there will be required 33,000 barrels of cement in the foundations, 120,000 cu. ft. of cement in the building itself, 1,215,000 cu. ft. of broken stone, 168,000 cu. ft. of terra cotta, 4,000,000 hollow tiles, 350,000 sq. ft. of marble trim and material for flooring, 1,350,000 cu. ft. of sand and 17,500,000 common brick. The estimate is about 5,500,000 more brick than was required for the Pennsylvania Railroad Terminal and about 10,000,000 more than was used in the construction of the twin Hudson Terminal buildings. There will be 152 steel supporting columns, the weight of the heaviest of which will be 32 tons. The structural steel work will require 18,000 gal. of paint to coat it. There will be 50 elevators in the building so arranged that if a firm occupies several floors it will have its own private elevator. All the elevator shafts will be enclosed in brick and will have fireproof doors. The stairways, enclosed completely in tile or brick, also have fireproof doors. The building will contain 5,000 windows and all offices will have washbasins with hot and cold water connections.

Vicars, Sons & Maxim, the well-known British engineering and shipbuilding firm, will establish a huge plant at Montreal. The shipyard will be capable of accommodating a ship 880 feet in length, or nearly 100 feet longer than the Mauretania.

Glossary of Terms Used in Road Construction

An interesting and valuable work has been completed by Mr. H. Percy Boulnois, M. Inst. C.E., Member of the Advisory Committee of H. M. Road Board (Great Britain), in the compilation of a glossary of road terms which appears in part in a recent issue of our London Contemporary, "The Surveyor," and which we are reproducing by the courtesy of that journal in the columns of the "Contract Record." In introducing his work Mr. Boulnois explains that he has made no reference to the various geological names of road-making rocks, but has contented himself with following the names settled by the Engineering Standards Committee. It is hoped that any omissions and errors will give rise to criticism of a constructive character.

Abrasion.—The act of rubbing off or wearing of a stone or other material.

Absorption.—The act or quality of a stone or other material to absorb water or moisture.

Abutments.—The supporting side walls of a bridge, but often applied to the sides or haunches of a road.

Acidphalte.—The trade name of an asphaltic composition.

Acme Paving.—The trade name of a special method of wood paving.

Adamant Stone.—The trade name of an artificial stone, flag or sett.

Adaptable.—The trade name of a horse sweeping-machine.

Adhesion.—The act or quality of adhering or sticking closely together.

Aeberli System.—The trade name of a method of road making.

Affinity.—Sometimes used to denote cohesion.

Agglomerate.—To gather together in a mass.

Agglutinate.—To unite or cause to adhere with a viscous substance.

Agglutinous.—The property of adhering or being in a viscous condition.

Aggregate.—"A sum, mass or assemblage of particulars," generally applied to the matter comprising the principal portion of the materials of which a road surface or concrete is formed.

Akonia.—The trade name of a dust palliative.

Alignment.—Laying out or regulating the ground plan as distinct from gradient or profile; the line of a road, or "to bring into line."

Alley.—A narrow street or passage.

Alluvial.—A geological term applied to recent deposits of soil or detritus washed down from rivers, etc., into valleys.

Almajan.—The trade name for a method of surfacing roads.

Ambulator.—An instrument for measuring road distances

Amiosite.—The trade name of a dust palliative.

Ammoniacal Liquor.—"An aqueous solution of ammonia and compounds of ammonia and of phenols."

Andesite.—The trade name of a road-making rock as settled by the Engineering Standards Committee.

Angular.—A material with sharp edges.

Annular.—Having the form of a ring.

Anthracene.—Heavy tar oil. An aromatic hydrocarbon produced in large quantities in the manufacture of coal gas, and found in the tar in varying proportions.

Antistaubite.—The trade name of a dust palliative.

Aplite.—A road-making rock, coming under the trade name of "granite," as settled by the Engineering Standards Committee.

Apokonin.—The trade name of a bituminous mixture for road construction.

Aqueduct.—A bridge carrying water.

Arcade.—A covered lane or passage containing shops

Argillaceous.—Partaking of the nature of clay.

Argillaceous Soil.—Soil of a clayey nature.

Arkose.—A road-making rock coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Arris.—The edge of a dressed stone or of a wood block.

Arterial.—A term applied to a system of streets diverging from a common centre, or joining up with main roads.

Artificial Asphalte.—A generic term applied to various bituminous compounds or mixtures containing more or less natural rock-asphalte.

Asphalte.—Sometimes spelt "asphalt." There has been some confusion in the use of this name. It was formerly understood to mean the natural asphalte rock found in certain localities, such as Val de Travers, Limmer, Seyssel, Lobsann, etc. This rock consists of pure carbonate of lime intimately combined and impregnated with mineral bitumen in variable proportions. The term is now applied to various bituminous mixtures.

Asphaltenes.—A term applied to certain components of bitumens in petroleum products, etc.

Asphaltic.—Of a character similar to that of asphalte, or containing a proportion of asphalte.

Asphaltic Macadam.—A term sometimes applied to tar-macadam, but a proportion of real asphalte is generally understood to have been used in its composition.

Asphaltoiline.—The trade name of a bituminous compound.

Asphaltum.—A mineral pitch not to be confused with asphalte. It is found in a soft or liquid state in some parts of the world. It is generally called bitumen.

Atlas Stone.—The trade name of an artificial flagstone.

Atomise.—To reduce to atoms, as in tar-spraying.

Attenuate.—To make thin or less viscid.

Attrition.—The act of wearing or rubbing down by contact. See also "Inter-attrition."

Avenue.—A long street or road of considerable width, and generally with trees planted on each side.

Axle.—The bar transferring the weight of a vehicle on to the wheels. All weights of vehicles are calculated by the weights on the front and back axles.

Baffles.—The plates in mixing machine which break up and change the direction of flow of the material, thus ensuring a perfect mixture.

Ballast.—A generic term applied sometimes to denote river gravel or stones, and also to the matrix of the material used in making concrete.

Barrel.—Or "barreling." The camber, contour, cross-section or crossfall of the surface of a carriageway.

Basalt.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee, including basaltic whinstone.

Base.—Sometimes used instead of the word "foundation" —for instance, "the concrete base" under setts.

Batch.—Any quantity of a material made at once; for instance, the charge put into a mixing machine.

Bath Mixer.—A special form of mixer used for mixing bituminous materials.

Batten.—A thin strip of wood, used, inter alia, between concrete "bays" laid in situ.

Batter.—The slope or inclination of the face of a retaining wall.

Bay.—A term used to denote a square of concrete paving; in bridges, the portion between the piers.

Bearing.—The solid support of a girder or beam

Beater.—See "Rammer."

Bed.—That on which anything rests, a layer or stratum; to embed or fix in a permanent position; to impose in a position a stone or a brick. Sometimes applied to the support of the foundation.

Beech.—A wood sometimes used for paving blocks.

Beetle.—A heavy wooden mallet or beater.

Benching.—Cutting or leaving edges or steps to strengthen embankments in process of construction.

Bench Mark.—A permanent mark used in levelling.

Bent Grass.—A grass largely planted to retain sand and prevent its being blown away.

Besoms.—A birch broom.

Beton.—A form of concrete in which large stones are embedded.

Betterment.—Increase in the value of property caused by a road or street improvement.

Bevel.—To cut away or slope off to an angle.

Bifurcate.—To divide into two. Where two roads meet at an acute angle they are said to bifurcate.

Billhook.—A hatchet with a long handle for trimming hedges.

Bin.—A box, generally of iron, in which is kept sand or gravel to be sprinkled on road surfaces when slippery. An "orderly bin" is used to receive the refuse off roads.

Binder.—A term sometimes used to denote small material used for binding an aggregate, and sometimes for the sand, gravel, or grit used to bind the surface of a water-bound macadam road. The word is also now used to designate various bituminous compounds used as binders to consolidate carriageways.

Binder Course.—A course of fine bituminous concrete spread between the lower and the upper crust of a road.

Binding.—The material used on ordinary macadam roads to bind the surface stones together. Sometimes called "blinding."

Bitulithic.—The trade name of a bituminous mixture.

Bituflux.—The trade name of a bituminous mixture.

Bitumen.—A mineral substance of a resinous and viscous nature, chiefly composed of hydrogen, carbon, etc. The word is often applied wrongly to residuums of distillation. If pure or natural bitumen is meant, the term should be prefixed by a qualifying description, as Trinidad Lake, Mexican, Ebano, etc.

Bituminous.—Containing bitumen or having a close resemblance to bitumen.

Bituminous Macadam.—See "Tar-macadam."

Black Ash.—Crude carbonate of soda.

Blades.—Fixed or movable projections.

Blanket.—A term used to designate a thin crust or carpet of some bituminous mixture laid on the surface of a carriageway.

Blast-furnace Tar.—A material obtained from blast furnaces, using Scotch splint coal as fuel.

Bleeding.—The exudation of pitch or bitumen from the road surface or from the prepared material.

Blending.—The act of mixing certain ingredients together in fixed proportions.

Blinding.—See "Binding."

Blocking Course.—The filling-in course or termination course of a row of paving stones, bricks, or wood blocks.

Blocks.—Pieces of wood or stone squared into shape, but which are not cubes.

Blowhole.—A small hole in the surface of asphalt or similar material caused by steam generated below in laying the hot material on a wet surface.

Blue Gum.—A species of Australian eucalyptus or gum tree, from which wood blocks for paving have been made.

Bond.—A joint, or a jointing material. The word is sometimes used to designate the cohesion of one material to another.

Boning.—The act of levelling by the eye with cross-heads called "boning rods."

Boost.—To raise something by packing it up from underneath.

Border.—The edge or verge of a country road. Sometimes the word "border stone" is used to designate a rough kerb.

Boring.—A small hole made to ascertain the nature of the subsoil.

Borrow Pit.—A pit or excavation from which earth is taken to make up an embankment or raised road.

Boss.—A thickened head or swelling.

Bottle-neck.—Applied to the short, narrow entrances of a street or road which afterwards widens.

Bottoming.—The lowest portion, or layer, of a carriageway resting on the ground formation. Now frequently called the "bottom course," or "bottom coat."

Boulder.—A large piece of rounded, waterworn rock.

Boulder Clay.—A tenacious clay of the glacial or drift epoch.

Boulder Pavement.—A pavement made with "cobbles" or large, rounded stones, now quite obsolete.

Boulevard.—Usually applied to a wide avenue or street which partly or wholly encircles a town, but the word is frequently used instead of "avenue."

Box-drain.—A drain with a flat top and bottom.

Breaking Track.—A term sometimes used to designate vehicles which do not follow in the same track.

Breasts.—Sometimes used to designate the outside portions or haunches of a carriageway.

Breast Wall.—A revetment wall.

Breccia.—A road-making rock, coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Breeze.—Small coal, ashes, clinker, or cinders; sometimes used for binding.

Bridle Path.—A path that can be used by horses, but not by a vehicle.

Briquette.—A small artificial brick or tile.

Brittle.—Easily broken, fragile, the reverse of "tough."

Buddle-hole.—A gully constructed partly under the kerb and footpath, with an elongated entrance parallel to the channel. (Local term).

Bumping.—A technical term used for the violent movement of tar, etc., when boiling.

Bunches.—A term sometimes applied to humps on the tops of "waves" in the surface of a carriageway.

Bunney.—A short, small culvert or drain. (Local term).

Burnetise.—A process of impregnating wood blocks with a solution of chloride of zinc.

Buthaltic.—The trade name of a special method of constructing tar-macadam roads.

But-joint.—A joint between two setts or blocks without any space between them.

By-pass Road.—Generally applied to a road which diverts the traffic for a short distance so as to avoid congestion of traffic in a town or elsewhere.

By-road.—A private or obscure road which diverges from a main or district road.

Calcareous.—Partaking of the nature of lime, or chalky.

Calcium Chloride.—A binary compound from calcium, a member of the alkaline earth group of elements. Largely used as a dust palliative.

Calkins.—The rough-pointed projections on a horse's shoe.

Caloric.—Pertaining to heat.

Camarco.—The trade name of a road composition.

Camber.—The convexity or curve of the cross-section of a carriageway. Also called "barrel," "crossfall," "curvature."

Camphor Wood.—A hardwood from Borneo, sometimes used for paving carriageways.

Camp Sheeting.—Close piling or boarding to resist pressure of earth, etc., from behind. Sometimes called "camp sheathing."

Cant.—To turn over, tilt, or place at an angle—for instance, a canted or hanging road.

Cantar.—The trade name of a hand tar-spraying machine.

Carbenes.—Components of bitumen petroleums, etc.

Carbon.—From "Carbo," a coal. It is insoluble and infusible.

Carpet.—A term used to denote a thin covering or coat of asphaltic, bituminous, or similar material on the surface of a carriageway.

Carriageway.—The part of a road used by wheeled vehicles.

Cart.—Formerly used to denote a two-wheeled vehicle without springs, but now generally used to denote an open vehicle on two wheels. Also used as a verb to denote the haulage or carrying of materials.

Catchment Area.—The area from which the surface or storm water is gathered.

Catch Basin.—See "Catchpit."

Catchpit.—A pit at the side of the road into which the surface water drains. Usually called a gully or gully pit.

Causeway.—A narrow road or street paved with stone. Generally applied to a raised road or a short road to a ford or ferry.

Cementation.—The binding power of any material to adhere together after having been broken into very small pieces.

Cementitious.—The binding property of any material.

Centigrade.—Consisting of 100 degrees; graduated into 100 divisions or equal parts. Specifically: Of or pertaining to the centigrade thermometer; as, 10 deg. centigrade (or 10 deg. C.).

Centimetre.—A French measure of length = .3937 of an inch.

Cesspit.—Sometimes used to denote a gully-pit or catchpit.

Chain.—A measuring, or "Gunter's" chain, 66 ft. in length and divided into 100 units.

Chaise.—An almost obsolete word for a certain type of vehicle.

Channel.—The gutter, or kennel, at the side of the carriageway. See also "Water table."

Charge.—To fill a vessel; or, used as a noun, the contents of a vessel.

Chart.—A plan, or tabulated form. A marine map.

Chase.—A groove or cut.

Chasm.—A deep and wide rift or fissure.

Checker.—Or "Chequer." To mark with little squares. Sometimes used to designate the scarifying or chequering of a road surface.

Cheek Crusher.—A stone breaker, with jaws or cheeks, as distinguished from a roller or drum crusher.

Chert.—A road-making rock, coming under the trade name of "flint," as settled by the Engineering Standards Committee.

Chips or Chippings.—Small fragments of stone, irregular in shape, with fine, short edges.

Chip Pavement.—A pavement composed of irregular stone spalls in the form of a mosaic.

Chock-a-Block.—Driven tight together.

Chord.—The straight line drawn from one end of an arc of a circle to the other end of the arc.

Chute.—A trough or channel for delivering water or other matters down an incline.

Cinders.—The residue remaining after burning coal in an ordinary fire, somewhat softer than ashes.

Circuitous.—Applied to a roundabout way or road.

Circulation.—Used to apply to the movement of traffic of vehicles on roads.

Circumferentor.—An obsolete instrument for taking angles in road surveying.

Circumfuse.—To spread around or pour over a surface. (Such as tar on a road).

Clare's Compounds.—A trade name given to various special bituminous compounds for making tar-macadam, or for spraying, etc.

Clay.—Fine-grained, non-indurated sedimentary deposit, plastic when wet.

Clay Puddle.—Clay or earth tempered with water and thoroughly worked up into a plastic condition. (See "Puddle.")

Cleavage.—The manner in which stones or similar materials split or divide.

Cleave.—To split.

Clinker.—Hard, vitrified, or burnt scoria or slag, etc. Sometimes rather loosely used to describe cinders.

Clod.—A lump or mass of earth or clay.

Coach.—Often applied indiscriminately to a vehicle, but generally understood to refer to a four-in-hand.

Coagulate.—To curdle or congeal.

Coalesce.—To grow together or unite.

Coal Tar.—See "Tar."

Coat.—A single application of tar or other material to the surface of a road.

Coating.—A covering or spreading of a material, such as stones on a road; also the application of tar or other material on the surface of a road. The word is used indiscriminately with "coat," as, for instance, top-coating, or top coat, etc.

Cobble.—A large pebble or rounded stone formerly used for paving carriageways or footwalks, but now obsolete.

Cob-Wall.—A wall built of clay mixed with straw.

Cocks.—Sometimes used instead of "calkins" on horses' shoes. (A local term).

Cofferdam.—A dam made of a double row of piles set close together with clay rammed between the rows of piles.

Cogs.—Sometimes used instead of "calkins."

Cohesion.—The force which binds the particles of any material together.

Colonnade.—A series of columns in a row. Generally applied to a covered, long portico with shops underneath.

Compo.—Another name for mortar.

Composite Paving.—A generic term applied to artificial paving.

Compressed Asphalte.—Natural rock-asphalte ground into powder, heated and rammed to form a road surface.

Concave.—A hollow or cavity; the reverse of convex.

Concrete.—Stones, gravel, or other materials mixed together with cement, water and sand. The term is sometimes employed in referring to tar-macadam as tar-concrete.

Conduit.—A pipe, tube, or other channel for the conveyance of water or other fluid.

Conglomerate.—A road-making rock, coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Consolidate.—To make solid, to unite or press together, as in rolling the surface of a road.

Contour.—The outline of a figure or body. Generally applied to the cross-section or cross-fall of the surface of a carriageway.

Convex.—Rising or swelling into a rounded form. The reverse of "concave."

Coping.—The top or cover of a wall.

Copse.—A small wood or coppice.

Corduroy.—A term given to the surface of a carriageway that has become ribbed or corrugated.

Cormastic.—The trade name of a special method of construction of the upper crust of a carriageway.

Corrugated.—Bent into folds or wrinkles.

Counterfort.—Projection of masonry or brickwork at the back of a retaining wall to strengthen it.

(To be continued.)

Rapid Building Progress at Calgary

Constructional Features of the More Important Undertakings Upon Which Operations are Being Pushed Vigorously

Correspondence of The Contract Record

Calgary, November 5, 1913.

RENEWED activity has been in evidence in the building business in Calgary and the prospects are that the coming year will be as good as 1912. Besides the many new buildings under way, there are several large structures being finished, these giving employment to a great deal of skilled labor.

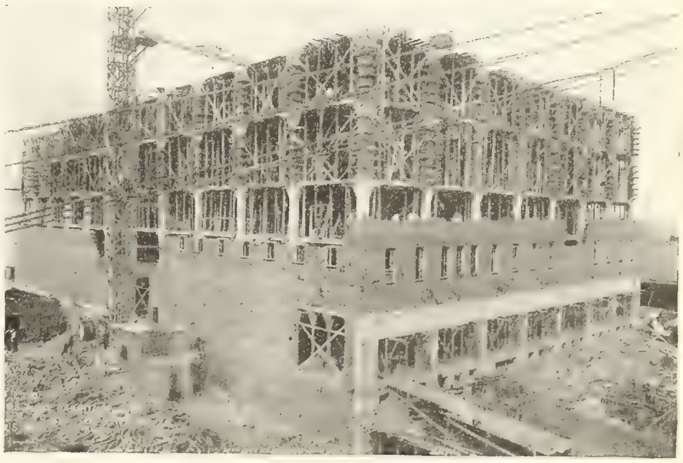
The new C. P. R. hotel, to be known as The Piedmont, is now in course of completion, giving employment to about three hundred mechanics. Both the large new buildings for the Herald Publishing Company and the Calgary Furniture Store are far enough advanced to give employment to an equal number of men. These three buildings alone represent a total expenditure of over $2,000,000. A great deal of activity is apparent in the offices of the local architects and quite a number of new structures have been commenced during the past two weeks. In addition to the new work, construction has been commenced anew on the six-storey office building for Senator James A. Lougheed. The building will cost close to $450,000 before completion and will be the first portion of a ten-storey block that, when completed, will occupy 150 feet along Eighth Avenue West, in the heart of Calgary's business district. The architects and builders are H. L. Stevens & Company, of Vancouver. The same firm of architects are preparing the plans and will construct a theatre on Eighth Avenue for Starland, Limited, owners of theatres in many western cities. As far as is planned at present, the building will have a frontage of 75 feet, and will house a theatre for vaudeville and motion picture circuits, having a capacity of 1,200 persons, The structure will be reinforced concrete, with terra cotta exterior, and will cost in the neighborhood of $200,000.

Noteworthy Industrial Buildings

There are many small business blocks now under way, all of which serve to give employment to practically all the labor available at present in the city. Among the more important buildings on which work has just commenced is the hotel and business block for P. O. Sullivan, to cost about $70,000. The building has a frontage on Seventh Avenue of 75 feet and will be three storeys high above the basement floor. The construction will be a reinforced concrete frame with laminated timber floors and the partitions. The exterior will be faced with enamelled brick manufactured locally by the Crandell Pressed Brick Company, Limited, of Calgary. The architect is J. B. Henderson, of Calgary. McDougall & Forster, Limited, of Calgary, have the contract. The Union Building Company, Limited, have been awarded the contract for the erection of a creamery building for P. Pallensen, of Calgary, at a cost of $18,000. The building will be of slow-burning construction, with brick veneer exterior and will contain creamery machinery for the business of the owner. Laing & Smyth, of Calgary, are the architects. Among the other buildings started is a warehouse for the Alaska Bedding Company, Limited, of Canada, being built by Carter-Halls-Aldinger Company, Limited, of Winnipeg.

The Hudson's Bay Company are now occupying their new premises and have sold their former store to the Royal Bank of Canada. The latter have commenced alterations to the old building before entering it themselves. The alterations consist in fitting the fifty feet adjoining the corner for occupancy by the local branch of the Royal Bank, the remaining fifty feet on the ground floor to be altered for the Woolworth Company, of New York, for a five and ten cent store. The second floor will be renovated and altered for office rental. Purdy & Henderson, of New York and Vancouver, have the contract, amounting to about $25,000. The architect is Kenneth G. Rea, of Montreal.

One of the largest industrial schemes now contemplated will be the flour mill and elevator for the Calgary Flour Mills Limited, a new company with a Dominion charter. They contemplate the erection at once of a flour mill having a daily capacity of 3,000 barrels at the beginning, to be increased later to give a maximum capacity of 6,000 barrels daily. A site aggregating 15 acres has been selected in East Calgary, where the mill will be served by all three railroads. In the same part of the city, it is the intention of the city of Calgary, co-operating with the railroads in establishing great central stockyards, for which a by-law has already been passed authorizing the expenditure of half a million dollars for the purpose of buying the site. The entrance of the Grand Trunk Pacific and of the Canadian Northern Railways through that part of the city will facilitate the rapid development of a greater Industrial Calgary. Recently the Canadian Malting Company, Limited, of Toronto, established a malting plant with elevators in this part of the city, and almost before the completion of the original plant, it was found necessary to double the capacity of the malt house, with a corresponding increase in the storage elevators.



Cold Storage Plant under construction at Calgary

As described in a former number of the Contract Record, the first construction consisted of thirty-two bins, having a total capacity of 400,000 bushels storage, with the required distributing tower, weighing hoppers, etc., serving the malt house. The bins in general consisted of a nest of twenty-two circular bins, ten of which are 21 feet in diameter, with 7-inch thick shells, and twelve are 13 ft. 10 in. in diameter, with 6-in. shells. The new installation consists of ten bins 21 feet in diameter, with 7-inch shells, forming a nest triangular in shape, to conform to the owners' property boundaries, giving a total of sixteen new bins having a capacity of 260,000 bushels storage. A total of 3,500 cubic yards of concrete were placed for foundations and bin walls. The contractors, the Canadian Stewart Company, Limited, of Chicago and Montreal, used their own patented moving forms in the construction of the circular tank walls, enabling them to complete the tanks proper, 90 feet high, 21 feet in diameter, in 16 working days of 24 hours. The weather conditions were excellent, enabling them to concrete as much as 8 ft. 6 in. vertical rise in 24 hours. All of the tanks have hopper bottoms, formed by concrete slabs on earth fill over the foundation slabs and feed on to 30-inch belt conveyors. A penthouse over the bins enables the tanks to be charged from two 30-inch belt conveyors. A third belt conveyor of the same size supplies the malt house from the storage. The double conveyors serving the elevator have a run of 575 lineal feet. The malt house has a capacity of over one million bushels a year, and is of reinforced concrete and solid brick wall construction. A second 250 h.p. Goldie-McCullough engine has been installed, making a total of 500 h.p. available. The boilers are gas fired, and the kilns of the malt house have been altered this year to be gas fired also. The conveyors are all operated by rope transmission. The plant has been erected complete according to plans and specifications of the Saladin Pneumatic Malting Construction Company, for whom Otto Luebkert, of Chicago, is the architect. The total cost will be in the neighborhood of $750,000.

Addition to Grain Elevator for Canada Malting Co., Limited, Calgary

The Canadian Northern has given evidence of increased activity in entering the city, and are now calling for tenders for the construction of temporary freight sheds and a temporary station building. These buildings will be placed in the heart of the future freight yard pending the erection of the steel for the crossings required to gain an entrance to the town. In East Calgary there will be an overhead crossing above the main canal of the Canadian Pacific Irrigation System and over the main line of the Canadian Pacific Railway and also a six-span bridge over the Bow River. Within their terminal there will be a subway crossing and a two-span crossing over the Elbow River at their proposed depot site. The steel for these bridges has just arrived and it is expected to have gangs at work before cold weather sets in. The Grand Trunk Pacific have their line graded and steel laid into the city and are only awaiting a settlement with the government for the purchase of the site of the barracks of the Northwest Mounted Police. In the meantime, they are proceeding with their permanent way construction, and have already commenced to build signal towers for interlocking control of their yards. The C. P. R. have only this year installed interlocking switching, but have about completed the control of the ninety odd miles of yards and terminals in the city limits.

The Canadian Pacific irrigation dam, at Bassano, was closed temporarily and had all but filled to the spillway when two of the temporary wooden gates failed, necessitating the emptying of the dam to the sills in order to replace the gates. It is expected to place the permanent gates this winter so that the entire system may be in full operation next year. In conjunction with the western section of this scheme, the railway has commenced construction on the diversion weir at the headgates for the main canal in East Calgary. Hayden & Skene, Calgary and Vancouver, have the contract and are about to commence construction at once. The same contractors completed the reinforced concrete headgates for this canal in the early spring. Considerable progress has been made in the main structures of the eastern section, such as the aqueduct, which will be 2,500 feet long, the main syphon and the completion of practically all the minor structures.

A great deal of interest has been aroused by the rapid progress in the construction of the new cold storage plant for P. Burns & Company, Limited, of Calgary and Vancouver. L. R. Burn, of Calgary, has the contract for the erection of the building, at a cost to exceed $225,000. The building is 198 feet long, parallel to the main tracks of the Canadian Pacific Railway and is 125 feet wide and six storeys high including the basement. But four months have elapsed since the contract was let, and the building is now ready for the owners, who will install all piping and ice machinery and provide and place all cork insulation. The excavation had been completed under a separate contract, as the building occupies the site of the building destroyed by fire in January of this year. Nevertheless, the contractor placed all of the 7,000 cubic yards of reinforced concrete in fifty-five working days, a delay of fifteen days awaiting the arrival of reinforcing steel, making an elapsed time of seventy days required for concreting. An average of 250 men were continually at work, daily, with an additional gang of 60 men on each night for concreting and laying steel. The forms were all timber and about 90 carpenters were employed at all times, the lumber being used twice. The concreting plant consisted of a one cubic yard Koehring mixer, charged by a loading hopper from the ground, the concrete being hoisted several feet above the floor and thence flowing down to a hopper placed on the floor, from whence the concrete was taken in carts to the more distant portions of the building. The hoist tower was an ordinary timber one, with an Insley bucket and hopper equipment. In addition, an Insley portable hoisting boom was used for handling forms and steel. A total of 410 tons of Havemeyer bars were used for the reinforcing steel in the flat slab system employed. The "system" used differs from others in that the square plate on top of the flaring column head has no reinforcing. The bands of small steel bars run from column to column in eight directions, as is usual and are supported over the column by a single heavy bar in the top of the plate, bent to a square. Columns are spaced 17 ft. by 17 ft. 6 in. and were placed in the proportion of 1:1½:3, the balance of the work being proportioned 1:2:4. A noteworthy feature of the building is the fact that the exterior walls, instead of being carried from floor to floor, as is usual in such framed buildings, are carried their entire height clear of the structural frame, in order to secure continuous insulation from the exterior. On the north side of the building is a covered shed over the two tracks of the C. P. R., that serve the building, while on the north side is the local shipping platform, protected from the weather by a steel, glazed canopy, cantilevered from the brick walls so as to eliminate columns. On these two sides. the exterior brick walls are carried on heavy reinforced concrete beams for the full height of four storeys; on the other two sides the brickwork is carried by reinforced concrete footing walls, monolithic with exterior column footings. The exterior is of local red pressed brick, 1,200,000 being placed at the rate of about 80,000 per day. E. H. Nichols is the engineer for the contractor and F. G. Carpenter for the owners. The building was designed in the office of Gardener & Limberg, of Chicago, who control the particular type of reinforced concrete construction described.

The Protestant Public School Board now has under construction two large stone schools, and are about to let the contract for four cottage schools. R. A. Brocklebank has about completed the placing of all reinforced concrete floors and stone walls for the 15-room school in Bridgeland, the finished building to cost about $190,000. Work is well under way on another such school in Balmoral sub-division—a 15-room school 170 feet long by 77 feet 6 inches deep, three storeys high, including the basement floor. The building stands in the centre of two city blocks, where it is intended to have a park and otherwise treat the site with the view of a "social center." In the basement, besides the heating plant, there will be a domestic science lecture room with adjoining kitchen, as well as manual training rooms and two playrooms. On the upper floor will be six class rooms, toilets and office, with a large assembly room intended to be used in the "social center" development. On the top floor will be fifteen class rooms, a library and two toilets. The exterior of the building will be of Calgary sandstone, of a better design than has been the rule in the local school architecture. Interior partitions are all solid brick walls, with reinforced concrete floors and stairs. The Kahn system of Floredome construction will be used, requiring about 300 cubic yards of concrete and about 200 tons of reinforcing steel. There will be, in addition to the main stairway at either end, an enclosed fire stair at the rear of the building. There will be a clock tower surmounting the slate mansard roof, the center of the dial being 70 feet above the grade in front. The building will be heated by a plenum hot air system, requiring two boilers. The general contract is being carried out by J. A. McPhail, of Calgary, the total cost to be above $200,000. These schools were designed in the office of the School Board, under Mr. H. McClelland, in charge of the Building Department.

J. McDiarmid & Company, Limited, of Winnipeg, have the contract for the Customs Examining Warehouse, and are making very good progress in the building. At the present writing, all of the structural steel has been erected, the reinforced concrete floors are being placed and the exterior walls are building. The structure will be as nearly fireproof as it is possible to make such buildings, the structural steel being fireproofed with concrete, the interior partitions being of concrete, with steel sash glazed with wire-glass, all floors being of reinforced concrete. In plan, the building is 200 feet long, 112 ft. 2 in. deep and is four storeys high above the basement. In the basement are the necessary mechanical equipment for the building, including boilers and transformers; on the ground floor there will be offices and the principal examining room. On the three upper floors there will be additional examining rooms, with the necessary offices and toilets. The main staircase will be in the middle of the front of the building, together with the elevators. There will be four electric freight elevators installed now, with provision for two others and one electric passenger elevator will be installed. The exterior will be of Calgary sandstone on the ground floor, with red pressed brick above with cut stone trimmings. The Manitoba Bridge & Iron Works, Limited, of Winnipeg, supplied 1,440 tons of structural steel for this building. In the erection the general contractors used a 10-ton derrick, with 40-foot mast and 70-foot steel boom, besides other smaller stiff-leg derricks. It is intended to add other storeys to the building in the future, so that the steelwork is apparently heavy for the present structure. The architect is David Ewart, Dominion Architect. Leo Dowler, of Calgary, is the local supervising architect for the government. The cost of the warehouse will be about $500,000.

Mr. J. L. Lang has been appointed assistant to the City Engineer of Galt. Mr. C. D. Campbell.

National Municipal League Convenvention in Toronto

THE Nineteenth Annual Meeting of the National Municipal League and the Twenty-First National Conference for Good City Government will be held in the Council Chamber of the City Hall, Toronto, November 12-15. The first formal session of the League will be held in Convocation Hall, University of Toronto. Addresses of welcome will then be given by His Worship Mayor Hocken, Sir James Whitney, Premier of Ontario, and President Falconer of the University. The annual review of the Secretary, Mr. C. R. Woodruff, of Philadelphia, will deal with the question, "Of What Does Municipal Advance Consist?" The annual address of the President, Hon. W. D. Foulke, of Richmond, Ind., will be devoted to the subject, "Public Opinion." The session on Thursday, November 13, will be devoted largely to the internal business of the League, a feature of outstanding interest being the presentation of a report by the special committee on the commission form of government. The discussion will be opened by Dr. E. S. Bradford, of Washington, D.C., author of "Commission Government in American Cities," by Mr. S. M. Worthington, City Manager of Sumpter, S.C., and by Mr. A. E. Adams, Youngstown, Iowa. The whole subject will then be thrown open for discussion.

Canadian cities have so much to show in the way of substantial municipal development that the whole of the session of Friday, November 14, has been set aside for the consideration of what they have accomplished, with the city of Toronto and the province of Ontario as illustrations. Addresses will be given by the Hon. W. J. Hanna, Provincial Secretary; Hon. Adam Beck, Chairman of the Ontario Hydro-Electric Commission; Mr. G. Frank Beer, President of the Toronto Housing Company, Limited, and Mr. F. S. Spence, member of the Board of Harbor Commissioners for Toronto.

The convention dinner will be held at the King Edward Hotel on Friday, November 14, at seven o'clock.

Personal Mention

Mr. Gordon M. West, architect, has opened an office at 2 College street, Toronto.

Messrs. Bovell & Molesworth, architects, Toronto, have dissolved partnership. Mr. G. M. Molesworth will continue to practice at 2 College street.

Mr. Chas. H. Keefer, of Ottawa, has been nominated for the office of Director, representing district No. 2, in the American Society of Civil Engineers.

Geo. Croft, a contractor of Cobourg, Ont., who was doing some concrete work in progress at the harbour there, was found drowned near the scene of operations last week.

Mr. Russell G. Swan has been appointed chief engineer of the British Columbia Hydrographic Survey of the Department of the Interior. Mr. Swan will be located at Vancouver.

Mr. John McGregor, of Reid, McGregor & Reid, contractors, Montreal, has been elected an alderman of Montreal West, defeating by five votes Mr. F. Peden, of Peden & McLaren, architects, Montreal.

Mr. R. F. Uniacke, Bridge Engineer of the N. T. R., delivered an illustrated lecture on the construction of the railroad at a recent meeting of the Canadian Railway Club, held at the Windsor Hotel, Montreal.

Mr. L. G. Denis, hydro-electric engineer for the Canadian Conservation Commission, recently returned to Ottawa after making a 1000-mile trip by canoe for the purpose of investigating water-power possibilities in northern Manitoba.

Tenth Annual Convention American Road Builders' Association

HIGHWAY improvement is a subject which has come to be recognized as one of the most important questions of the day, and interest in it is becoming more widespread as its economic features are better understood. Many millions of dollars are being expended annually for the improvement of rural roads and city streets, and many more millions will be spent each year in the future. The problem of how this money should be spent in order to secure the best results involves questions of vital concern, requiring careful study on the part of those upon whom the responsibility is placed. It is for the careful consideration of these questions that a convention is held each year under the auspices of the American Road Builders' Association.

Although over a month has yet to pass before the Philadelphia convention of the Association, it is already evident that the calling to order of the meeting on the forenoon of December 9 will mark the opening of the most successful of its long series of notable conventions. The program prepared and the speakers so far selected promise technical sessions of unusual interest and value. Applications for exhibition space already received show that the exposition of road building machinery and materials will be one of the most complete ever assembled, and the widespread interest being taken by officials, engineers and contractors connected with road work indicates an attendance of actual road builders larger than has ever been present at a similar meeting.

As previously noted, the technical sessions will be arranged in much the same manner as last year and the year before. The general subject of highway work is to be considered under three heads—organization, construction and maintenance. The particular phases of each of these subdivisions will be covered by papers presented by men chosen because of their training and experience, and the presentation of each paper will be followed by a discussion by several especially selected speakers and then thrown open to the meeting.

Among those who are to take part in the proceedings, either by reading papers or in discussions following the presentation of papers, are the following: Chas. J. Bennett, State Highway Commissioner of Connecticut; E. M. Bigelow, State Highway Commissioner of Pennsylvania; A. H. Blanchard, Professor of Highway Engineering, Columbia University, New York, N.Y.; Henry L. Bowlby, State Highway Engineer of Oregon; Frank W. Buffum, State Highway Commissioner of Missouri; John N. Carlisle, State Highway Commissioner of New York; Wm. H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; Geo. W. Cooley, State Engineer of Minnesota; F. L. Cranford, Road Contractor, Brooklyn, N.Y.; Major W. W. Crosby, Chief Engineer, Maryland Geological Survey; A. W. Dean, Chief Engineer, Massachusetts Highway Commission; Fred E. Ellis, Road Contractor, Peabody, Mass.; A. B. Fletcher, State Highway Engineer of California; S. D. Foster, Chief Engineer, Pennsylvania State Highway Department; R. B. Gage, Chemist, State Highway Department of New Jersey; John S. Gillespie, Road Commissioner of Allegheny County, Pa.; L. R. Grabill, Superintendent of Suburban Roads, District of Columbia; H. C. Hill, Engineer, Lane Construction Co., Meriden, Conn.; A. R. Hirst, State Highway Engineer of Wisconsin; Prevost Hubbard, Consulting Chemist, Institute of Industrial Research, Washington, D.C.; Jos. W. Hunter, Deputy Commissioner, Bureau of Township Highways, Pennsylvania State Highway Department; A. N. Johnson, State Highway Engineer of Illinois; C. A. Kenyon, President, Indiana Good Roads Association; Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, New York, N.Y.; James H. MacDonald, former State Highway Commissioner of Connecticut; T. H. MacDonald, State Highway Engineer of Iowa; W. A. McLean, Chief Engineer of Highways and Commissioner of the Ontario Public Roads and Highways Commission, Toronto, Ont.; Mr. Robert A. Meeker, State Highway Engineer of New Jersey; Harold Parker, Vice-President, Hassam Paving Company, Worcester, Mass.; Robert J. Potts, Professor of Highway Engineering, Agricultural and Mechanical College of Texas, College Station, Tex.; Dr. Joseph Hyde Pratt, State Geologist of North Carolina; Jean de Pulligny, Engineer-in-Chief, Board of Public Works of France, and Director of the French Mission of Engineers to the United States; John J. Ryan, Secretary, Road Builders' Association, Albany, N.Y.; Frank F. Rogers, State Highway Commissioner of Michigan, Chas. W. Ross, Street Commissioner, Newton, Mass.; Paul D. Sargent, Chief Engineer, Maine State Highway Commission; Herman H. Schmidt, Chief Engineer, Bureau of Highways, Borough of Brooklyn, New York, N.Y.; Henry G. Shirley, Chief Engineer, Maryland State Roads Commission; Francis P. Smith, Consulting Chemist and Paving Engineer, New York, N.Y.; Robert C. Terrell, Commissioner of Public Roads of Kentucky; Geo. W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N.Y.; Wm. D. Uhler, Assistant Engineer, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; P. St. J. Wilson, State Highway Commissioner of Virginia.

The exhibition, which will be the fifth of the series held in conjunction with the A. R. B. A. conventions, bids fair to be one of the largest and most complete expositions of machinery, materials and methods ever held. It will comprise machinery for road work and street paving, materials for roads and pavements, models illustrating methods of highway construction and maintenance, maps, charts and photographs, and a variety of educational features. In addition to the usual commercial exhibits of road and street machinery and material manufacturers and dealers, it is planned to have interesting and instructive displays by states, municipalities and educational institutions. The Province of Ontario will be represented by an exhibit.

Saskatoon Association of Architects

The annual convention of the Saskatchewan Association of Architects was held in Saskatoon on October 25th last. The meeting was well attended and many important subjects came up for discussion, notable among which were technical education and architectural competitions. It was decided to petition the government for better facilities for technical education and to appoint a committee to approve of the conditions drawn up in respect to architectural competitions.

The reports submitted disclosed the fact that there are 103 registered members of the Association. Federation with the Royal Architectural Institute of Canada has been effected and the Association has become affiliated with the University of Saskatchewan.

The visiting architects were entertained at a luncheon given by the Saskatchewan Chapter and the convention came to a close with the annual banquet, which was held in the Saskatchewan Club.

The election of officers resulted as follows: President, Mr. W. G. Van Egmond, Regina; Vice-Presidents: Mr. R. G. Bunyard, Moose Jaw, and Mr. A. G. Creighton, Prince Albert; Secretary-Treasurer, Mr. F. C. Clemesha. Members of council: Professor A. R. Greig and Mr. David Webster, Saskatoon; and Mr. A. F. Favell, North Battleford. Examining Board: Professor A. R. Greig, Saskatoon; Mr. T. B. Daniel, Saskatoon; Mr. F. C. Clemesha, Regina; Mr. A. L. Favell, North Battleford, and Mr. R. M. Thompson, Saskatoon.

C.P.R. Grade Separation at Toronto

The C. P. R. is carrying out the grade separation work on its line across the northern part of Toronto in compliance with the Railway Commissioners' order, which called for the elevation of its tracks as well as those of the Canadian Northern line which is projected to enter Toronto from the west along a route following that of the C. P. R. most of the way through that part of the city.

The viaduct is to be built for five tracks, and will be about two to three miles long, covering the more congested part of the route. Of these five tracks, the northerly one will be used as a service track by the C. N. R., as that line connects at both ends with the C. P. R. service. Of the three central tracks, the two northerly are to be built at once, and will be used jointly for through service. The fifth track is not to be built at present, but provision is made for it as occasion may require.

One subway only has been built to date, that at Avenue road. The others will be proceeded with as ordered. The Avenue road subway is 66 feet wide, with a roadway clearance of 14 feet. It is of concrete substructure construction, with the former street level about five feet. McPherson avenue enters the subway from the west on the north of the tracks, requiring a slight street diversion with a retaining wall. Along that side all street approaches are on a five per cent. grade.

The subway is crossed on steel plate girders. Work on this subway has been carried forward without interruption to train service by leaving one track at grade and building the concrete abutments on both sides of the track, finally carrying the service across on a trestle bridge at the new elevation and building in the open space in the abutments. The elevation work between the subways has been carried forward in a similar manner, leaving the southerly track open at grade, and building a trestle in the north side, on which traffic was diverted. The portion that so far has been elevated is the section from Summerhill avenue, near Davenport road, including Yonge street crossing, which is now being carried on a temporary timber trestle. The two northerly tracks are completed and the others are being pushed forward. On this section the elevation is about 12 feet above the former grade.

New York's New Canal

The exact condition of the barge canal in New York was explained recently in an illustrated lecture by State Engineer John A. Bensel before the New York State Waterways Association Convention.

"At present more than 250 miles of the barge canal is actually completed to the dimension size and all of the more important structures are more than 80 per cent. finished," he said. "During the last year construction work to the amount of $13,000,000 has been done. The total work to date amounts to about $64,000,000. On the remaining contracts yet to be finished the sum of about $82,000,000 will be expended.

"Work on the terminals in New York, Brooklyn, Utica, Buffalo, Albany, Syracuse, Oswego, Schenectady, Amsterdam, Troy, Ithaca and other cities is progressing with great rapidity. About thirty-five contracts have been let, and one terminal, that at Albany, has been put into use in a commercial way."

The British firm of Baldry, Yerburgh and Hutchinson, Limited, contractors, of Westminster, London, have been awarded the contract for the construction of the second section of the Welland Canal at $5,500,000. This company is one of the oldest established firms of contractors in Great Britain. Although they have successfully carried out large contracts on the other side, such as those for the construction of the Canada and the Herculaneum Docks in Liverpool for the Mersey Dock and Harbor Board, and others for most of the great British railways, this will be the first time that they have undertaken work in the Dominion of Canada. A large number of men will be engaged on this new undertaking for the next three years. The headquarters for the present will probably be at St. Catharines. All the latest mechanical appliances will be installed, and the firm will hope to secure contracts for more of the six sections yet to be awarded. The total cost of the whole undertaking will be about $52,000,000. Robert Yerburgh, M.P. for Chester, in the British House of Commons, is one of the partners. Mr. Hutchinson, the active member on this side, will be assisted by Mr. A. E. Rigby.

Mainly Constructional

The News in Brief—From Coast to Coast

For the next five years three million dollars per annum will be expended by the Montreal Harbour Commissioners on harbour works.

The Hamilton Home Construction Company, Limited, is a new concern, with head office at Hamilton, incorporated with a capital of $100,000.

At Prince Albert, Sask., the value of the building permits to date amounts to approximately $1,500,000, compared with some $2,000,000 for the corresponding period of 1912.

The Toms Contracting Company, Limited, is a new concern, with head office at Toronto, incorporated with a capital of $40,000, to carry on business as brick manufacturers and dealers in building materials.

During October Montreal building permits totalled $6,765,300, an increase of $3,918,892 over the corresponding month last year. For the nine months the value was $22,581,466, a gain of $6,407,744 over 1912.

The Montreal Builders' Exchange have issued a year book compiled by the secretary, Mr. R. L. Werry. It contains considerable information of a general and local character, including data on estimating for various kinds of work. The year book is of very handy form, and is illustrated.

Plans for a system of overflow sewers designed to relieve the flooding which occurs during times of heavy rainfall were passed at a special meeting of the works committee of Hamilton, Ont., recently. It is estimated that the system will cost in the neighborhood of $650,000. It is intended to discharge this storm water into the bay, it being practically impossible to treat it, but the affluent will be of such a diluted nature that no harm can come from it.

Plans for buildings to cost $1,987,027 were approved by the Toronto City Architect during the month of October, representing an increase of nearly half a million dollars in comparison with the figures for October a year ago. For the first ten months of 1913 permits for the erection of buildings at an estimated cost of $24,247,631 were issued by the Department as against permits representing $23,814,003 worth of buildings for the corresponding period of 1912.

The city of Edmonton, Alta., has been enjoying considerable building activity of late. The building expenditure to date amounts to nearly ten million dollars and includes many substantial business buildings and costly residences. The number of permits issued is upwards of fifteen hundred. The most noteworthy building enterprise is the Chateau MacDonald, described in a recent issue of the Contract Record. This building in itself represents an expenditure of two million dollars.

Judgment for $3,600 has been awarded by Mr. Justice Panneton, of the Superior Court, Montreal, to the Lewis

Building Company against Dame Marie Leduc, whose business consists of demolishing buildings. The Lewis Company, the owners of a new ten-storey office building, contracted with defendant to pull down the old structure, there being a penalty clause of $200 per day. There was a delay of thirty-six days, and on action being taken the defendant consented to judgment for $3,600.

According to a despatch from Paris, France is planning an expenditure of over three hundred million dollars for harbour and internal navigation improvements. The cost is to be distributed over the next fifty-six years, although the actual work will be completed in the near future. Over forty-one million dollars of the total expenditure is involved in projects now under way.

The growth of St. John is reflected in the building returns for the past month and for the year ending October 31. The inspector, Mr. James Carleton, reports that during the month of October there were issued 15 building permits for structures of the value of $835,200, against 21 certificates in October, 1912, for buildings of the value of $52,800. The certificates for the year ending October 31 were for buildings of an aggregate value of $1,838,660, and for the year ending October 31, 1912, only $520,700.

One of the most important road schemes in Eastern Canada is that recently launched for an expenditure of $1,000,000 in Essex county, Ontario. The by-law will be voted on next January, after which each city and town will vote separately on the amount to be given the good roads fund. The by-law calls for concrete roadways covering no less than 150 miles, and connecting all important communities. An interesting feature of the plan is the provision of a continuous route of good roads. In the completed project no interruptions of bad road stretches will appear.

It is officially announced that a large extension of McGill University is contemplated. Plans are being prepared for three new buildings—a $300,000 gymnasium, dormitories to cost between two and three million dollars, and a government armory, the latter to be built and equipped by the Government. The gymnasium will probably be started in the spring, and the dormitories as soon as the University can get the money. The Minister of Militia has promised that the armory will be ready by next year. All the buildings will be on Macdonald Park, the new campus, at the foot of the mountain.

A deputation from several Montreal business institutions, including the Builders' Exchange (represented by Messrs. T. Gilday and R. L. Werry) and the Architects' Association of the Province of Quebec (represented by Mr. J. Perrault) on November 4 interviewed the Montreal Civic Controllers and suggested the establishment of a fire prevention bureau. This should be under the charge of the chief of the fire department, and should consist of an inspector in each of the thirty-seven fire stations which at present exist in Montreal. The Controllers asked the deputation to put their wishes into the form of a draft by-law.

Plans for the proposed new east wing of the court house building at Vancouver are being prepared by Messrs. Dalton & Eveleigh. It is understood that the work will cost in the neighborhood of $300,000. The principal purpose of the new wing will be to provide proper accommodation for the land registry office and perhaps a court and suite of rooms for the judges of the court of appeal. The requirements make it impossible to duplicate the west wing, but the general form and character of the main building and west wing will be followed. The government has not reached a final determination on the details of the plan and tenders have not yet been invited.

The Canadian Stewart Company, Limited, of Montreal and Chicago, have the contract for an addition to the warehouse of the Canadian Consolidated Rubber Company, Limited, on Tenth Avenue West, Calgary. The existing building has a frontage of 57 feet 11 inches, and the addition will have a frontage of 75 feet, making the building nearly 133 feet in front. It is 110 feet deep and will have five storeys and a basement. The exterior walls are of solid brick construction, on concrete foundations, the interior being of mill construction, with 2 x 6 laminated floors throughout. The roof will be covered with a 5-ply tar and gravel roofing. The estimated cost is $100,000.

Mr. F. S. Baker, of Toronto, in an open letter to the Mayor, appeals for an amendment of the Ontario Architects' Act to such a degree that it will ensure the efficient registration of the architectural profession. This is apropos of the appointment of a new City Architect—an unnecessary official, Mr. Baker maintains, if the architectural profession were properly qualified and answerable to the public for the safety of their structures. At present, Mr. Baker says, the city architect's staff, which is a very large one, is employed in checking plans and specifications prepared by architects who are presumably qualified. This he considers an expensive and unnecessary duplication.

The town of Aurora, Ont., has decided to install an equipment of motor-driven turbine pumps for protection against fire. It will include two four-stage high lift turbine pumps of Mather and Platt design, built by Canadian Allis-Chalmers Limited. Each of these fire pumps will be capable of delivering four hundred imperial gallons a minute, against a total head of 325 feet, operating at 1,460 r.p.m. They will be direct-connected at one end to an alternating current motor, and at the other end to a direct current motor in order to conform with the Underwriters requirements that there must be two distinct sources of power for this purpose. The electrical apparatus, including a four-panel switchboard, will be built by the Canadian General Electric Company, Limited.

The council of the Institution of Civil Engineers (Great Britain) have made the following awards for papers published in the "Proceedings," without discussion, during the session 1912-1913: A Telford Gold Medal to Mr. James Mackenzie (Johannesburg); Telford Premiums to Messrs. H. Hawgood (Los Angeles), J. K. Robertson (Bombay), G. S. Perry (Sydney, N.S.W.), and Gervaise Purcell, B.A. (Los Angeles); and the Crampton Prize to Mr. William Mason, M.Sc. (Liverpool). The council have made the following awards in respect of students' papers read before provincial associations of students during the past season: The James Forrest Medal and a Miller Prize to Mr. P. M. Chadwick, B.Sc. (Birmingham), and Miller Prizes to Messrs. A. J. S. Pippard (Bristol), T. P. Geen (Bristol), C. E. Holloway, B.Sc. (Bristol), J. W. Burns (Glasgow) and B. A. E. Heilig (Birmingham).

Canadian Railroad Development

The Canadian Pacific Railway is planning on rebuilding the main lines entering Toronto, Ont., and placing all wires within the municipality under ground.

The Great Northern Railway has purchased considerable land in the vicinity of Calgary and Lethbridge with the object of extending a line into the wheat regions.

The Canadian Northern Railway is planning to begin double-tracking its line between Winnipeg and Fort Frances as soon as its transcontinental line is completed.

The British Columbia Electric Railway, Vancouver, B.C. has negotiations under way with the Great Northern Railway for purchase of abandoned right-of-way of Cloverdale-Blaine line from Hazelmore to the Canadian boundary at Blaine, Wash.

The first section of the transcontinental railway declared completed and ready for traffic is the fifty-mile stretch from the Quebec bridge west on the north shore, built by the contracting firm of Messrs. M. P. & J. T. Davis.

When the Grand Trunk Pacific is completed the new and old company will have, between them, 10,000 miles of track. At present the C. P. R. has over 12,000 miles of track, and has at least 1,500 additional under way in the northwest and the portions of Ontario which it has invaded.

Final location for the Canadian Northern Railway from Athabasca to Peace River Crossing has been completed and will be placed before the Department of Railways for final approval at once. It is understood that the line will continue from Athabasca to a point about six miles up river, where it will cross and follow the north side of the river to Sawridge, continuing along the north shore of Lesser Slave Lake to Grouard and on to Peace River Crossing. Another branch is contemplated from a point just north of Athabasca to tap the Grande Prairie country and will probably connect with the company's line from Edmonton at Sturgeon Lake.

A new freight shed for the Grand Trunk Railway has been completed at Point St. Charles, Montreal. It is 1,200 feet long by 60 feet wide, and will be used entirely for Montreal freight in bond, it having been decided to concentrate all the railway's bonded business in the building. The walls are of brick on concrete foundations. The roof, between the walls, is supported by steel columns and covered with tar and gravel. There are seventy-six bays in the shed, and the length is divided by fire walls at proper distances apart. The building is parallel with Wellington street and has been set back thirty feet therefrom. This space of thirty feet has been paved as a teamway with granite blocks. The cost is $185,000.

The new G. T. P. floating dry dock at Prince Rupert, B.C., will be one of the largest and best equipped in the world and will be electrically-operated throughout. The contract for the electrical equipment which has been awarded by the G. T. R. to the Canadian General Electric Company, Limited, includes two 200 h.p. and four 100 h.p. variable speed induction motors, with full automatic control, for operating the pumps on the deck. The power will be produced by two 1,250 kv.a. Curtis steam turbines with complete condensing apparatus. The exciters for the main turbine-generators will consist of three 35 kw. turbine driven generators, and one motor generator set. The foundry, machine shops, and ship yards will be equipped with motor driven tools, requiring motors ranging from 60 to 10 h.p. The contract for electrical equipment also includes all necessary power and light transformers.

While Sir Thomas Shaughnessy was in Chicago recently he had a look at the new terminals which the "Soo" line, in affiliation with the C. P. R., is building there. This is an immense structure, covering no less than eleven blocks of city space in the heart of the city. This is to be the central receiving and distributing station for the "Soo" lines. The work involves a considerable amount of reinforced concrete, probably more than any other similar work. Over 1,000 yards of concrete are being placed by a single shift in a day, and concreting has been in progress since January 7. Four great distributing towers, each over 300 feet high, serve the work. Seven car loads of Portland cement are received at the works every day, and the storage piles of sand and stone cover one acre. The terminal consists of a deck structure, continuing uninterrupted across the streets, permitting the use of the area beneath the deck for storage and freight handling, except the streets left open for traffic. The terminal faces the projected 12th street boulevard on the north and extends south between Canal and Clinton streets as far as 15th street, where it turns west, connecting with the Baltimore & Ohio Chicago Terminal Railway tracks at Halstead street. There is to be an in-freight house of four storeys with 600,000 square feet additional storage area beneath the tracks. The structure is of reinforced concrete throughout. Construction was started in August, 1912, and at the present time about 460,000 square feet of track slab have been completed. The ground covered is 18 acres, and the area of the working space is 34 acres. This will give an idea of the size of the structure when completed. It has been rendered necessary by the vast increase in the business of the "Soo" lines, which are now being operated under the guidance and control virtually of the C. P. R.

The last bolt of the new double-track C. P. R. bridge across the St. Lawrence was driven on November 4 by Mr. McNicoll, vice-president of the company, thus completing one of the largest undertakings of the C. P. R. The double-tracking has taken about five years and has cost $4,000,000. Mr. McNicoll placed a silver bolt in position in the presence of a party of officials of the C. P. R. and Dominion Bridge Company, the work having been carried out by the latter company. The party included Mr. McNicoll, vice-president of the C. P. R.; Mr. A. B. Motley, chief engineer of bridges; Mr. J. M. R. Fairbairn, chief engineer; Mr. A. D. McTier, general manager of eastern lines; Mr. C. N. Montserrat; Mr. Phelps Johnson, general superintendent of the Dominion Bridge Company, and Mr. G. H. Duggan, chief engineer of that company. After the placing of the bolt the first train passed over the new span.

Trade Publications

From Canadian Allis-Chalmers, Limited, we have received a publication descriptive of the McKiernan-Terry Rotating Hammer Drills. It is claimed that in nearly all cases the tool of this make may be used more profitably than any other type for sinking, stoping or drifting. The drill is of the self-rotating, hammer type and within the range of the work for which it is designed will drill more ground with less power than a piston machine. The lines embraced in this manufacture are rock drills, pile hammers, hammer drills, atlas ball-bearing jacks, core drills, air compressors, mining and quarrying machinery.

Catalogue No. 900 of the Orenstein-Arthur Koppel Company, for whom the Canadian Fairbanks-Morse Company, Limited, 444 St. James Street, Montreal, are the Canadian agents, has just reached us. The catalogue conveys a comprehensive idea of the Koppel Company's products, comprising rails, portable track switches, turn-tables, cars, steam and electric locomotives. The catalogue is well illustrated and highly educative along the above-mentioned lines. The noteworthy features of design and construction are too numerous to mention within the restricted space of this review. Copies of the catalogue may be obtained upon application to the Canadian Fairbanks-Morse Company, Montreal.

"Wizard" Rock Drills for which the Canadian Allis-Chalmers Company, Limited, Toronto, are Canadian agents, are described in an interesting pamphlet just to hand. These drills are manufactured by the McKiernan-Terry Drill Company, who claim to combine in their drills all the refinements of design, material and workmanship. This pamphlet contains a detailed description of the Corliss Valve drill. In this drill a quick and easy valve action and the liberal area of the ports, provide a means for changing rapidly from pressure to exhaust and so impart instantaneous motion to the piston which causes it to operate at a much higher velocity than is possible for other types of tappet drills. It is economical and powerful in service and is adapted to exacting conditions.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Ont.

Town Council (Waterworks and Elec. Light Dept.), Sec., D. C. Davis, contemplate purchasing Duplex steam pump, size 17 x 10 x 12, required, slight variation in dimensions not detrimental.

Brockville, Ont.

Boiler house, cost $17,000, contemplated by Municipal Council (Water & Light Dept.). Chairman, C. S. Cossitt. Manager, E. J. Philip. New boilers, etc., to be purchased for pumping station. Report has been submitted to Railway Commission for approval. Estimated cost $52,000.

Estevan, Sask.

Council will instal sewer system on 1st, 2nd, 3rd, 4th, 5th, 6th, 8th 12th and Valley Sts. Sec.-Treas., P. J. Stephens.

Council will lay cement sidewalks on 14 streets. Sec.-Treas., P. J. Stephens.

Ottawa, Ont.

Pavement, cost $30,000, Bronson Ave., planned by City Council between Laurier Ave. and Gladstone Ave. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

City Council plan repaving between Sparks and Gladstone (about 1 mile long) with asphalt, probably widening the sidewalks to 10 ft. Mayor, J. A. Ellis. City engineer, Arch. Currie.

Tenders received by Chairman Water Works Commission until Nov. 14th, for 50 Corporation Hydrants. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

Toronto, Ont.

Board of Control plan concrete walks on 19 streets, estimated cost $33,000. Asphalt on Eastmount, Hain, Oakwood and Tyrell, estimated cost $14,152. Rocmac on Hain, cost $2,932. Mayor, H. C. Hocken.

Pavements planned by Board of Control. Mayor, H. C. Hocken. Tenders received until November 18th. Asphalt on Alma, Arlington, Carns, Rushton, Wells Hill ave. Bitulithic on Arlington, concrete on Plymouth. Grading on Aldergrove, Bain, Glenmore, Morley, Springmount, Spears.

Sewers on Ascot, Benlamond, Springmount, Dufferin-Midway Drainage System (Gerrard and Hiawatha), planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Nov. 18th.

Tenders received by Engineer, Frank Barber, C.E., 57 Adelaide E., until Nov. 15th for sewer on Bathurst St.

Commr. of Works, R. C. Harris, recommends grading on following streets, Beresford, Fourth, Walder, Rosedale Heights. Estimated cost $6.500. Board of Control. Mayor, H. C. Hocken.

Commr. of Works, R. C. Harris, recommends sidewalks on Annette, Coxwell, DeSavery, Glebe, Glen, Hatfield, Millwood, Manor, Osler, Pears, Penrose, Oswald, Paton, Servington, Thurloe, Tullis, Wharram, Rushton. Estimated cost $30,000. Board of Control. Mayor, H. C. Hocken.

Board of Control plan 24 ft. asphalt pavement on Rose Ave. Estimated cost $9,407. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Board of Control plan tile pipe sewers on Hemlock and Lauder Lane, west of Markham, south from Ulster. Estimated cost $9,684. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Board of Control plan concrete sidewalks on Broadway, Eastern, Humberside, King and Rowland. Estimated cost $2,196. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Commr. of Works, R. C. Harris, recommends asphalt on Cruickshank, cost $2,221, and concrete walks on Gilmour, Coxwell and Danforth Ave., cost $6,000.

Concrete sidewalk planned. Clark, W. A. Clarke, 40 Jarvis St. Council was petitioned to lay 4 ft. walk on Baby Point Rd. and Baby Point Cres. By-law for sidewalk on Howland Park Ave. passed 1st reading.

CONTRACTS AWARDED

Brockville, Ont.

Pavement, cost $5,000, Market Square, planned by Town Council. Mayor, Jno. McKenzie. Clerk, Geo. Dewey. Engineer, Geo. Bryson. General contractors, Godson Contracting Co., Ltd., Manning Chmbrs., Toronto.

Edmonton, Alta.

Bitulithic pavement, Jasper Ave., planned by City Council. Engineer, A. J. Latornel. General contractors, National Paving & Constr. Co., Clark and 1st St.

London, Ont.

Sewers planned by City Council. Mayor, C. M. R. Graham. W. J. Johnston & Co., 602 Princess Ave., William St. (1st Sec.), $1,170; (2nd Sec.), $825. Harding Constr. Co., London, Adelaide St., $2,028, and Oxford St., $3,500. C. Leathorn, 862 Elias St., Burwell St., $862. Work to start as soon as possible.

Swift Current, Sask.

Sewers and water main planned by Town Council. Sec.-Treas., G. D. Arnott. Engineer, G. D. Mackie. General contractors, McManus Contracting Co., Moose Jaw, at $10,600, for sewer tile, and $6,622 for water pipe.

Weyburn, Sask.

Wells and laterals, cost $50,000, planned by City Council. Mayor, M. C. Taggart. Sec.-Treas., J. D. Murray. Work being done by day labor. Wells about completed, laterals not to be started until next spring.

Railroads, Bridges and Wharves

Ainsworth, B.C.

Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 17th. Plans, specifications, etc., at offices of J. P. Forde, Dist. Engineer, Revelstoke, B.C., C. C. Worsfold, Dist. Engineer, New Westminster, Postmaster, Ainsworth, and at Dept., Ottawa.

Bengough, Sask.

C. N. O. Rly. has approved location of 3rd class station here.

Calgary, Alta.

Subway, cost $98,000, 4th St., planned by City Council. Clerk, J. M. Miller By-law to be submitted to ratepayers.

Callender, Ont.

Extension to wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received until Dec. 1st. Plans at Ottawa, Confed. Life Bldg., Toronto, Dist. Engineer, Midland, and Post Office at Callender. Wharf 120 ft. long, with 100 ft. "L" 20 ft. wide. Substructure timber cut work filled with stone. Timber superstructure.

Deseronto, Ont.

C. N. O. Rly. has approved location of station at Deseronto, Twp. Tyendinaga, Co. Hastings, Ont., at mileage 134 from East Don.

Empress, Sask.

C. P. Rly. has approved location of station at Empress, on Swift Current Northwesterly Branch.

Gull Harbour, Man.

Wharf planned by Dom. Govt. Dept of Public Works. Sec., R. C. Desrochers Ottawa. No action taken. New tenders to be called.

Heustis Landing N.B.

Wharf. Tenders received by Sec., R C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works. until Dec. 1st. Plans etc., at offices of Dist. Engineers, Fredericton, N.B.; St. John, N.B.; Postmaster, Heurstis Landing, and at Dept., Ottawa.

Hope, B.C.

Kettle Valley Rly. Co. has been authorized to construct bridge over Fraser River.

Huntingdon Twp., Ont.

G. T. Rly., has been authorized to construct siding into premises of Quinlan & Robertson, on lot 10, Con. 9.

North Bay, Ont.

C. N. O. Rly. has approved plan No D. 29-1 of subway to be constructed at Wylde St.

Province of Ont.

G. T. Rly. has been authorized to construct siding into premises of St. Marys Portland Cement Co., Ltd., being part of lot No. 22, Con. 17, Twp. Blanchard, and to connect spur with existing siding and spurs serving applicant's plant and rescinding Order No. 19365 May 21st, 1913 also authorized to construct bridge No 58, at mileage 146.42 from Black Rock carrying 20th Dist. of its railway across

Bayfield Creek at a point 2.11 miles east of Clinton Station, Twp. Tuckersmith, Co. Huron, Ont.

Ottawa, Ont.

Tenders received by L. K. Jones, Ottawa, Dom. Govt. Dept. of Railways and Canals, until Nov. 12th, for improving Lower Entrance to Lock No. 20 Ontario - St. Lawrence Canals, Cornwall Canal. Plans, etc., at office of Chief Engineer of above Dept., Ottawa, Supt. Engineer of the Ontario-St. Lawrence, Cornwall, Ont.

Penetang, Ont.

G. T. R. has been authorized to construct siding into premises of Gidley Boat Co.

Qualicum, B.C.

Esquimalt & Nanaimo Rly. has approved location of station at Qualicum Beach on Comox Extension of its railway, Vancouver Island.

Richards Landing Ont. (St. Josephs Island)

Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Dec. 2nd. Plans, etc., at office of Dist. Engineer, Sault Ste. Marie, J. G. Sing, Confed. Life Bldg., Toronto, Postmaster, Richards Landing, and at Dept., Ottawa. Wharf 180 ft. long, 18 ft. wide, timber crib substructure, concrete, block superstructure.

Seagrave, Ont.

G. T. Rly. has approved location of station at Seagrave, Twp. Reach. To replace one recently destroyed by fire.

Steelton, Ont.

Street car service planned by the International Transit Co., Sault Ste. Marie. All work to be done by owners. Rails supplied by the Lake Superior Corporation, Sault Ste. Marie.

Stratford, Ont.

Covering Erie Creek planned by City Council. Mayor, C. N. Greenwood. Clerk, R. R. Lang. Recommended by Board of Works that the City Engineer be authorized to prepare plans and estimates for above work.

G. T. Rly. has been authorized to construct bridges No. 44 and 47 over Wellington St. and John St.

Toronto, Ont.

Harbor work planned by Dom. Govt. Dept. of Public Works. General contractors, Can. Stewart Co., C. P. R. Bldg. General Contractors open for tenders on pile driving, capping crib work and concrete walls, for ship channel, Toronto Harbor.

Harbor equipment. Can. Stewart Co., C. P. R. Bldg., are in market for tugs, derrick boats, floating pile drivers, barges and floating equipment, for work in Toronto Harbor.

Bridge planned by Municipal Council of Locust Hill. 450 ft. span. Estimated cost $22,000, steel, or $28,000 concrete.

Board of Control, has been authorized to construct bridges at Strachan Ave. over tracks of C. P. R. and G. T. R. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Tyee, B.C.

G. T. P. Rly. has approved station site at Tyee, mileage 26.5, Prince Rupert East in lot 27, Rge. 5, Coast District, B.C.

Vercheres, Que.

Quebec, Montreal & Southern Rly. Co. has been authorized to construct siding for Mount Royal Brick Co., Ltd., Parish of Varennes Co.

Winnipeg, Man., St. Boniface

C. P. Rly. has been authorized to construct spur for Continental Oil Co., Ltd., Winnipeg, from a point on westerly limit of its line in lot M, plan 252.

CONTRACTS AWARDED

Amherst, N.S.

Extension to wharf, cost $16,440, planned Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Maple Leaf Lumber Co., Amherst (Pres., Percy C. Black). No sub-contracts to be let. Further information from President, or J. I. Loy, Amherst. Pile drivers and hoisters required by General Contractors, also derricks, wire and cable. Extension 250 x 84, piles foundation, solid pile facing.

Edmonton, Alta.

Bridge, cost $10,000, Wentworth St., planned by City Council. Engineer, A. J. Latornel. General contractors, National Paving & Constr. Co., Clark and 1st St.

Ft. William, Ont.

Addition to car barns, cost $40,000, Walsh, planned by City Council. Architect, City Engineer. General contractor, P. J. Donahue, Cameron Block, S. May St.

Newington, Que.

Engine house extension. Owners and general contractors, Quebec Central Rly. Co. General manager, J. H. Walsh, Sherbrooke. Architect, H. G. James, Whiting Block, Sherbrooke. Mechanical Engineer, Geo. Robins. Q. C. R. Shops. Work done by day labor. One storey, 5 stalls, 150 ft. rear, 65 ft. front, 70 ft. deep, walls, asbestos corrugated boardmill construction.

North Cobalt, Ont.

Car barns, cost $25,000, Lakeview Ave., for Nipissing Central Rly., North Cobalt. Architects, Smith, Kerry & Chace, Confederation Life Bldg., Toronto. General contractors, Suttcliffe & Neelands, New Liskeard. One storey, 65 x 180, felt and gravel roofing.

Province of Quebec

Bridge, cost $2,900, over S. Branch of Yamaska River, planned by Twp. of Brome. Sec.-Treas., Geo. F. Hall. Concrete work being done by day labor. Steel, MacKinnon, Holmes Co., Sherbrooke. One span, 30 x 17, concrete and steel.

Sussex, N.B.

Station planned by Dom. Govt., Dept. of Railways & Canals. Secretary, L. K. Jones, Ottawa. General contractors, British American Construction Company, Prince William Street. Foundations in.

Winnipeg, Man.

Station, St. Boniface (Desmeurins St.), for C. N. Rly., Winnipeg. Architect, R. B. Pratt, C. N. R. Arch., Union Depot, Winnipeg. General contractors, Benoit & Co., St. Boniface. Excavating done.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.

Office and lodge building planned for I. O. O. F. Building will be started in 1914. Site on Nelson and Market St. To apply for charter under name of Oddfellows Temple, Ltd. Capital $90,000.

Calgary, Alta.

Hospital, cost $30,000, contemplated by City Council. City Clerk, J. M. Miller. Site not yet selected. Tenders to be called early in the spring.

Cross Lake, Man.

Boarding school planned by Dom. Govt. Dept. of Indian Affairs. Deputy Supt. General, Duncan C. Scott, Ottawa. Tenders received by Supt. till noon Jan. 2nd. Plans, specifications, etc., at Indian Office, Winnipeg. Offices of Indian Agent, Portage la Prairie, Agent of Dominion Lands, Brandon, and at Post Office, Kenora.

Daysland, Alta.

School equipment required by Public School Board. Further information from Sec.-Treas. of School Board.

East Hamilton, Ont.

Post office, cost $40,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa.

Edmonton, Alta.

City market, cost $10,000, 1st St., planned by City Council. Mayor, Mr. Short, Civic Office. Clerk, C. Cox, Civic Office. Architect, A. H. Wheeler, Civic Office. Work to start at once. Three storeys, 65 x 150, brick and stone construction.

Drill hall. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 18th. Plans, specifications, etc., at office of A. Beaton, Clerk of Works, Edmonton, H. E. Matthews, Superintending Architect of the Dom. Public Bldgs., Winnipeg, and at Dept., Ottawa.

Fredericton, N.B.

School, Smyth St., planned by School Board. Sec., Chas. Sampson, Architect, F. Neil Brodie, 42 Princess St., St. John. Committee appointed, Dr. Van Wart, chairman, and Messrs. Weddall and Sterling, to inspect Fisher Memorial School, Woodstock, before plans are drawn. Building to start in spring.

Gananoque, Ont.

Alteration to Town Hall planned by the Town Council. Mayor, W. N. Rogers. Architect, B. Dillon, Brockville, Ont.

Glace Bay., N.S.

Hospital, cost $60,000, subtenders open Architect, Leslie R. Fairn, Aylesford. General contractors, Chappell Bros., Sydney. Carpenter, Mr. Mills, c/o General Contractors. Roofing, Shaw & Mason. Plans, etc., at office of Sec. of Com., J. T. Martell, who will receive tenders until Nov. 19th for low pressure steam heating system with air line and automatic heat control with ventilation. Three stys.

Halifax, N.S.

Tenders received by Dom. Govt., Department of Public Works, Secretary, R. C. Desrochers, Ottawa, until Nov. 24th, for alterations and addition to Post Office and Savings Bank fittings. Plans, etc., at office of W. Bishop, Supt. Dom. Buildings, Halifax, and at Dept., Ottawa.

Hamilton, Ont.

Hospital, Mountain Top, planned. Chairman, T. H. Pratt. Local architects, Stewart & Witton. Adv. architect, E. F.

Stevens (Stevens & Lee), 2 College St., Toronto.

Homer, Ont.
Church, cost $10,000, for St. George English Congregation. Matter being considered by Anglican Synod of Niagara. Plans will be prepared.

Kingston, Ont.
Church contemplated for R. C. denomination. Archbishop Spratt has purchased site, cor. of Thomas and Russell streets.

College buildings contemplated by Regiopolis College Board. Present buildings sold. New building to be built up town.

Milltown, N.B.
Public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 27th. Plans, etc., at office of D. H. Waterbury, Supt. of Bldgs., Post Office Bldg., St. John, N.B., Postmaster Milltown, and at Dept., Ottawa.

Montreal, Que.
Alterations to convent, cost $27,000, St. Catherine Road, planned for Soeurs Missionares de l'Immaculee Conception, 314 St. Catherine Rd. Architect, Chas. Chausse, 17 Pagnuelo ave. Specifications for painting held up. Contract to be awarded in about two weeks.

Dormitories, McGill and Sherbrooke, contemplated for McGill College. Principal Peterson, Montreal. Plans will be prepared.

Theatre, cost $20,000, Park and Bernard, for Mr. Joly, St. Viateur W. Architect, Z. Trudel, 238 St. Andre St. Plans drawn.

Children's hospital, cost $35,000, for Children's Memorial Hospital, Cedar Ave. Architects, Brown & Vallance, 44 Canada Life Bldg., Montreal. Contracts will be awarded in a few days.

Church, Decarie Blvd., for St. Lukes Congregation. Rev. W. R. Cruikshanks, 115 Drummond St. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg., receiving tenders now for foundation work. Tenders for General Contractor to be called in about a week.

Postal Station "G," Clarke and Prince Arthur, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Ross & MacDonald, 1 Belmont St., Montreal.

Ottawa, Ont.
Synagogue, Bank, contemplated. Address, J. R. Fogle, 384 Bank St. Plans not yet drawn.

Port Colborne, Ont.
Electric wiring and interior fittings, public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 20th. Plans, etc., at office of Thos. Hasting, Clerk of Works, Station "F," Yonge St., Toronto, Caretaker of building, Port Colborne, and at Dept., Ottawa.

Regina, Sask.
Tenders for school supplies for the year 1914, received up till noon Nov. 24. Full particulars from Sec.-Treas., J. H. Cunningham, Alexandra School, Hamilton Street.

St. Catharines, Ont.
Parish hall and residence, cost $8,000, contemplated by St. Barnabas Anglican Congregation. Permission granted by Synod to enlarge Parish Hall, $4,500, and erect Rectory, $3,500.

St. John, N.B.
Church, cost $8,000, East, contemplated by the Anglican Synod. Will not build till next year.

Sarnia, Ont.
School, cost $30,000, Devine St., planned. Chairman, A. N. Hayes, M.D., 142 Christina. Building that was burned to be rebuilt and additional rooms added. All interior fittings required.

Stonewall, Man.
Public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 24th. Supt. Architect of Public Bldgs., H. E. Matthews. Plans, etc., at office of Post Master, Stonewall, and at Dept., Ottawa.

Summerside, P.E.I.
Addition and alterations to public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Dec. 1st. Plans, etc., at office of J. J. HcDuff, Supt. Dom. Bldgs., Charlottetown, P.E.I., R. MacSween, caretaker, Public Bldg., Summerside, and at Dept., Ottawa.

Toronto, Ont.
Church planned by Trustee Board of Mt. Dennis Pres. Church. Interested, Mr. James Syme, McPherson avenue. Meetings now being held in public school.

Addition to club quarters, University Ave., planned for Toronto Musical Protective Union No. 149. Special committee proposes spending $10,000 on improving building.

Catholic School Board are considering enlarging St. Francis School on Manning Ave. Sec., Joseph Cadaret, 24 Duke street.

The J. Singer Estate, Queen W. Company have purchased 3-storey building, 37 x 100, upper floors will be altered for lodge rooms and club quarters. Owners will do work by day labor. Work to start about Nov. 15th.

Welland, Ont.
Church, cost $40,000, Hellens Ave. and Griffith St., for R. C. Church Congregation. Architect, A. W. Holmes, 10 Bloor St. E., Toronto. Contract to be awarded in about 10 days.

Windsor, Ont.
Veterinary hospital and residence, cost $5,000, Pelissier, contemplated for Dr. A. E. Bowman, V.S. Architect not chosen.

Winnipeg, Man.
Church, cost $50,000, Cathedral Ave., planned for St. Johns Presbyterians, Cathedral Ave. Pastor, J. P. Jones, Bannerman Ave. Architect, R. C. Smith, Somerset Bldg. Contract will be awarded for the remainder of building next year.

CONTRACTS AWARDED

Beaconsfield, Que.
Alterations to club house, cost $55,000, for Beaconsfield Golf Club (R. J. Tooke, Montreal). Architects, Brown & Vallance, Can. Life Bldg., Montreal. General contractors, Atkinson, Glassco & Lawrence, 45 St. Alexander St., Montreal. Work to start at once.

Bracebridge, Ont.
Post office, cost $35,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Simcoe Constr. Co., 16 King St W., Toronto. Painting and glazin Joseph Bryon. Plumbing and hea W. F. Martin. Three storeys, brick a steel construction.

Brantford, Ont.
Church tower and chimes, cost $45,000, for Grace Anglican Church. Rector, Rev. G. C. MacKenzie. Committee, A. J. Wilkes, K.C., W. F. Cockshutt, M.P., A. K. Bunnell. Architect, G. B. Cleveland (Darling & Pearson, Toronto), 2 Leader Lane, Toronto. Foundations, Schultz Bros. Co., Ltd., Brantford, $3,000. Chimes presented by Major R. W. Leonard, St. Catharines. 103 ft. high, 45 x 45, stone and concrete foundation, stone construction.

Brockville, Ont.
Arena, cost $11,853, Gilmour, for Brockville Arena Co., Ltd. President, M. Atkinson. Sec.-Treas., L. C. Dargavel Architect, A. Stuart Allaster. General contractors, Parslow & Horton. One storey, 220 x 109. Foundations in.

Cobalt, Ont.
Town Hall, cost $15,000. Mayor, A. Z. Trudel. Town clerk, R. L. O'Gorman. Architects, Angus & Angus, North Bay. General contractors, Hill, Clark & Francis Ltd., New Liskeard. Walls started

Edmonton, Alta.
Bath, cost $28,000, planned by a Syndicate. Pres., W. H. Helier. Manager, Jno. Dawson. Director, H. A. Dickey, 678 21st St. Architect, E. Underwood, Chisholm Block, Jasper Ave. W. General contractor, B. Karran, 24th Street. Plumbing and heating, F. MacLean, Mutching Block, Jasper Ave. E.

Ft. William, Ont.
Addition to orphanage, cost $25,000, Franklyn, planned by Roman Catholic Denomination. Architect, H. R. Halton, Port Arthur. General contractor, C. Mathieu, Fort William. There will be an assembly hall or chapel in connection with above. Seats probably wanted.

Haileybury, Ont.
Court house, cost $62,000, Main, for Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughten, Toronto. General contractors, P. H. Secord & Son, Brantford, Ont. Work has been suspended until spring, when building will be completed. Foundations in.

Hamilton, Ont.
Stores and apartments, cost $10,000, for T. W. Hand, 584 King St. W.. Architects, J. A. Ardes & Walter Scott, Federal Life Bldg. Steel, Hamilton Steel Construction Co., Lottridge St. Roofing, M V. Maclean, 314 Hess St. S. Painting, A Kemp, 36 Fairholt Rd. Heating and plumbing, Dickinson & Allan, Barton & Emerald. Electrical, Culley & Breay, 27 King St. W.

Kingston, Ont.
Rifle Ranges planned by Dom. Govt., Dept. of Militia & Defence. Secretary, E. E. Jarvis, Ottawa. General contractor, A. C. T. McMaster, 74 Victor ave., Toronto, $6,400. Work to be finished by June, 1914.

Montreal, Que.
Interior fittings, cost $6,000, Postal Station "B," St. Catherine W. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, J. T. Ewart Dept. of Public Works. General con-

tractor, J. T. Schell, Alexandria, Ont. Marble, Smith Marble & Constr. Co., 145 Van Horne Ave. General Contractor doing all other trades.

Ottawa, Ont.

School, cost $85,000, Bronson, planned by Public School Board. Architect, W. B. Garvock, Creighton St. School. Carpenter, Taylor & Lackey, 1st Ave. Walls started.

Alterations to hall, residence and conservatory, cost $4,000, for W. E. Matthews, Clemok Ave. Architect, J. P. MacLaren, 104 Sparks St. General contractors, Johnston & White. Mason, T. C. James, 104 Flora. Heating and plumbing not let yet. Conservatory, Lord & Burnham Co. Brick veneer construction, concrete foundation.

Church, cost $40,000, Metcalfe St., for Christian Scientists, Metcalfe St. Architect, J. P. McLaren, 104 Sparks St. Painting, Geo. King, 121 Slater St. Electrical, Marchand & Donnelly, Sparks St.

School, cost $140,000, Rosemount, planned by Ottawa School Board. Sec., Crawford Ross, Elgin St. Architect, W. B. Garvock, Creighton St. School. Carpenter, Alex. Christie, Elgin St.

Regina, Sask.

Lodge Hall, cost $10,000, Retallack, for Sons of England Institute. Sec.-treas., E. Peachey, P. O. Box 1175. General contractor, Roger Edwards, 1667 Athol street. Occupants, Sons of England Institute.

Garbage transfer station, cost $15,000, planned by City Council. M. H. O., Dr. M. R. Bow. Architect, R. W. Allen, City Engineer's Office. General contractors, Frid Lewis Co., Ltd., 901 Somerset Bldg., Winnipeg. 2½-storeys, brick and reinforced concrete construction.

St. John, N.B.

Observatory, cost $25,000, Douglas ave., for Dom. Govt., Dept. of Meteorological Service. Architect, Garnet Wilson, 50 Princess street. General contractors, British American Construction Co., Prince William street.

Sandwich, Ont.

Addition to Registry Office, cost $20,000, Bedford and Huron, planned by Essex County Council. Chairman, Enos McCausland, Essex. Architect, James Pennington, Windsor. Masonry, Thompson Bros., Windsor. One storey, 50 x 50. Excavating started.

Toronto, Ont.

Theatre, cost $6,000, 1067 Bathurst St. Owner and general contractor, J. Burford, 14 Vermont ave. Two storeys, 28 x 110, brick foundation, brick and steel construction, felt and gravel roofing. Store fronts and fixtures, seating.

Church, cost $30,000, Jones Ave., for St. Clements Anglican Congregation. Architects, Sharp & Brown, 18 Wellington E. Mason, W. A. Bulley, 458 Pape Ave. Carpenter, J. Lambert, 312 Westmoreland Ave. Walls up.

Westboro, Ont.

Church, cost $11,000, for Presbyterian Congregation. Pastor, Rev. W. H. Cram. Architect, J. P. MacLaren, 104 Sparks St., Ottawa. Painting and heating, J. Stewart, Westboro.

West London, Ont.

School, cost $25,000, planned by Board of Education. Chairman, E. R. Dennis. Architects, Watt & Blackwell, Bank of Toronto Bldg. General contractor, Walter Dann, 795 Lorne ave. Two storeys, white brick construction. Foundations in.

Winnipeg, Man.

Addition and alterations to theatre (Strand), Main St., for Stein, Mayer & Stein Vanderbuilt Circuit, Chicago, Ill. Architects and general contractors, Northern Constr. Co., Union Bank Bldg.

Business Buildings and Industrial Plants

Amherstburg, Ont.

Garage, cost $7,000, contemplated for Amherstburg Garage Co., Dalhousie St. Concrete blocks and red pressed brick construction. Plans will be prepared.

Brantford, Ont.

Three stores, offices and lodge, cost $60,000, Nelson and Market streets, for I.O.O.F. Chairman of Committee, Chas. W. Cowherd, Supt. Cockshutt Plow Co., Ltd. Members of committee, Thomas Doodyatt, Jas. A. Spence, T. L. Wood and Chas. Parker. Plans in progress.

Blenheim, Ont.

Addition to factory contemplated for British Canadian Canners. Manager, T. A. Agnew. Architect to be selected.

Dundas, Ont.

Bank building for Royal Bank of Canada, H. O. Montreal. Architect, J. Walker, c/o Owner. Concrete and brick construction, Roman stone. Plans prepared.

Edmonton, Alta.

The Winnipeg Ceiling & Roofing Co., Ltd., Winnipeg, plan to enlarge their plant. Manager, W. J. McMartin, Edmonton Metal Works. Machines for corrugating iron and other manufacturing work required.

Grimsby, Ont.

Plant planned for The Pelee Island Wine & Vineyard Co. Pres., Major J. S. Hamilton, Brantford. Factory, 3 storeys, 150 x 60, cooper shop and storage building, 100 x 30, engine and boiler house, stone, brick or cement and fireproof construction, cost of buildings, $30,000, plant $30,000. Railway switches to be laid.

Kingston, Ont.

Iron and tube plant planned for Kingston Iron & Tube Co. $75,000 bonds guaranteed. By-law passed and company will start plant at once.

Markham, Ont.

Abattoir contemplated by F. T. Newton. Site purchased and plans will be prepared.

Montreal, Que.

Restaurant, alterations, St. Catherine W. and Bleury, for North Eastern Lunch Co. (Mr. Craig, St. Catherine W. and Mansfield Sts.). Architect, Mr. Heggie, 573 Lasalle Rd., Verdun, will call for tenders. Tile and marble work let.

Dairy contemplated for Gunn Langlois & Co., Ltd., 241 St. Paul. Plans will be prepared.

Store and ice cream parlor, cost $15,000, planned for Geo. Nicholas & Co., 322 St. Catherine W. Architect, D. J. Crighton, Jacobs Bldg. Contract will not be awarded till spring.

Petrolia, Ont.

Addition to factory, cost $70,000, contemplated for Petrolia Waggon Works. Architect to be selected. White brick construction. Machinery required.

Business block, cost $15,000, contemplated for H. Rotsky, Wonderland Theatre. Architect to be selected. Two stys., white brick construction. Plans will be prepared.

Sarnia, Ont.

Bank, remodelling, Front, for Industrial Mortgage & Savings Co., 283 N. Front St. Manager, D. N. Sinclair. Office fixtures, etc., required. Plans in progress.

Sault Ste. Marie, Ont.

Lumber mills. The Andrews Lumber Co., Ltd. Owners are operating 60 miles north of the Sault at Alona Bay. Capital of company $150,000, dock is being built of solid rock, 1,000 ft. long, with "L" across one end 125 ft. long x 25 ft. wide, and "L" 35 ft. wide. Owners are also building circular mill (re-saw to be installed later), tie, shingle and lath, mills output to be about 4,000,000 ft. hardwood, 3,000 to 5,000 cords spruce pulpwood, 25,000 to 35,000 cedar ties, 5,000 to 10,000 cedar poles, and about 50,000 cu. ft. white pine board timber.

Scott Junction, Que.

The Beauce Pulp & Lumber Co., 68 Peter St., Quebec, are considering plans for new mill, to replace one destroyed by fire.

Sherbrooke, Que.

Elbram Stone Company are negotiating with city for concessions with view to building factory for the manufacture of "Elbram Stone." Sec., D. Simoneau.

Stratford, Ont.

Addition to factory planned for The Avon Hosiery Co., 82 Erie St. Local manager, W. Pearson. Ratepayers voted on by-law to loan company $25,000.

The Stratford Mfg. Co., Ltd., manufacturers ladders, lawn swings, etc., has asked City Council for fixed assessment for 10 years and permission to close College St. in order to double size of plant.

Toronto, Ont.

Wood-working factory planned for Beverley Wood Specialty Co., 91 Niagara St. Company have applied to York Twp. Council to close Renora Cres., east from Blackthorn.

Garage, cost $18,000, 19 Agnes, for Cawthra Estate, 11 King St. E. Tenders received by Architects, Bond & Smith, 15 Wilton Ave. Old buildings on site to be torn down at once. Two storeys, 50 x 102, reinforced concrete construction, concrete foundation.

Tile drain for warehouse, for C. H. Elton, 465 Adelaide W. Tenders received by Owner for 600 ft. of 9 in. tile drain.

Warehouse, Sydenham, for S. B. Hinter, c/oArchitect, E. G. Wilson, 77 Victoria St. Tenders received by Architect. Four storeys, brick and mill construction, brick foundation, felt and gravel roofing.

Wabanum, Alta.

Branch factory contemplated for Hunt Manufacturing Co., Walla Walla, Washington, U.S.A. Manufacturers of threshing machines and agricultural implements.

Winnipeg, Man.

Factory planned for Berliner Gramaphone Co., 415 St. Catherine W., Montreal. Architect, E. M. Berliner, Wash-

(Continued on page 71)

Tenders and For Sale Department

Bridge Tenders

Tenders will be received by the undersigned at the Court House up to 2 p.m. on **Tuesday, November 25th, 1913**, for 40 ft. concrete girder bridge for county line between Waterloo and Wellington. Alternate tenders will be received for steel bridge. For further information apply to

BOWMAN & CONNOR,
Civil Engineers,
46 Berlin, Ont.

TENDERS

Sealed tenders will be received up to seven o'clock precise, **Saturday, November 29th, 1913**, for the construction of a steel bridge with concrete pillars across the Beaudette River in the Parish of St. Telesphore, Soulange, Co., P.Q.

Tenders must be accompanied by a certified cheque for 10 per cent. of the amount, and should be addressed to the Secretary-Treasurer of the Municipality of the Parish of St. Telesphore, Soulange Co., P.Q. The Council is not held to accept the lowest or any other tender.

Plans and specifications can be seen at the office of the Secretary-Treasurer.

Separate tenders can be prepared, one for the concrete pillars, and the other for the steel superstructure or for both.

JAS. ED. CHARLEBOIS,
Secretary-Treasurer.
St. Telesphore, Nov. 6, 1913. 46-48

Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension to Wharf at Callendar, Ont.," will be received at this office until 4 p.m., on **Monday, December 1, 1913**, for the construction of an Extension to Wharf at Callendar, District of Parry Sound, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Bldg., Toronto, Ont., Midland, Ont., and on application to the Postmaster at Callendar, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—4976 45-46

WANTED

Duplex Steam Pump, Size 17 by 10 by 12. Slight variation in dimensions not detrimental.

J. L. MILLARD,
45-46 Aylmer, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf and Warehouse at Richard's Landing, Ont.," will be received at this office until 4 p.m. on **Tuesday, December 2, 1913**, for the construction of a Wharf and Warehouse at Richard's Landing, St. Joseph Island, Algoma District, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' Office, Sault Ste. Marie, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Richard's Landing, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 31, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48268. 45-46

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuses, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
45-46 Woodstock, Ont

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Thursday, November 18th, 1913**, for the construction of the following works:

SEWERS

Ascot Ave., from Dufferin Street to W.S. of St. Clair Ave.
Benlamond Ave., from Main Street to West End.
Springmount Ave., from Oakwood Ave. to Mount Royal Ave.
Midway Drainage System, Gerrard and Hiawatha via Hiawatha.
Fairford and Ashdale to 520 feet N. of Fairford.
Dufferin St., from 500 feet North of St. Clair Ave. to 90 feet North of Morrison Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or officers of the corporation of the City of Toronto), or in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control
Toronto, November 5th, 1913. 46

Toronto Harbor

Equipment Wanted

We are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on our work in

PROPOSALS WANTED

from

Experienced Contractors

for

Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to

CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

Tenders for Construction of Sidewalk

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Saturday, November 15th, 1913**, for the construction of concrete sidewalk on Baby Point Crescent, in the Township of York.

Plans, specifications and all necessary information may be seen at the office of Frank Barber, C.E., 57 Adelaide St. East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, November 11, 1913. 46

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect. No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Contractor with Steam Shovel, Cars, Track, Horses, Scrapers, etc., would like to hear from parties having railroad grading or other work to let. Address "Contractor," c/o Contract Record, Toronto. 46

Wanted by a large firm of builders and contractors who are opening a branch in Eastern Canada, Catalogues and Price Lists for Builders' Supplies, Construction plant, lumber, etc. Also applications from sub-contractors for the various trades. Apply Box 908, Contract Record, Toronto. 46

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Business Buildings and Industial Plants

(Continued from page 69)

ington, D.C. Nothing further will be done this year.

Windsor, Ont.

Bank and offices, Sandwich St. E., for Canadian Bank of Commerce. Manager, A. E. Taylor. Site purchased and plans will be prepared.

Bank building, Ouellette Ave. and Chatham St., for Merchants Bank of Canada. Manager, Geo. Carruthers. Site purchased and plans will be prepared.

Store building, cost $8,000, Pitt E., contemplated for Simon Meretsky. Architect not chosen. Brick construction.

CONTRACTS AWARDED

Assiniboia, Sask.

Hotel, cost $22,000. Owner and general contractor, Jos. Thompson, Viceroy, Sask. Architect, Geo. J. G. Jarrett, Weyburn. Three storeys, 50 x 85, brick veneer construction, cement foundation, maple and B. C. fir floors. Felt and gravel roofing. Excavating done.

Brandon. Man.

Warehouse, cost $8,925, for Provincial Govt., Dept. of Public Works. Minister, Hon. Colin Campbell, Winnipeg. Architect, V. W. Horwood, Winnipeg. General contractors, The Willows Co., Ltd., Brandon. One storey, 30 x 62, corrugated iron roofing. Walls up.

Bradford, Ont.

Factory planned for Watson-Smith Co., Ltd., 161 Geary Ave., Toronto. Foundations, Mr. Sparling Meaford. Brick, Geo. MacDonald. Brick work to be completed by Nov. 30th.

Brantford, Ont.

Store and offices, cost $3,800, Dalhousie, for Joseph Hall, 223 Darling St. General contractor, J. W. Fogal, 252 Dalhousie. Plumbing and electrical not let. Two storeys, 24 x 50, concrete foundation, pressed brick construction, felt and gravel roofing.

Calgary, Alta.

Warehouse, cost $10,000, 10th Ave. Owners and general contractors, Gray & Campbell, Ltd. Supt., J. J. McQuire, 1735 11th Ave. W. Architect J. J. O'Gara, McLean Block. Heating and electrical not let yet. Work done under supervision of Architect. Two storeys, 50 x 20, brick veneer and mill construction. Foundations in.

Cobalt, Ont.

Bank building, cost $9,000, Prospect Ave., for Bank of Ottawa. Manager, Samuel Smythe. Architect, J. P. MacLaren, 104 Sparks St., Ottawa. General contractors, Hill, Clark & Francis, New Liskeard. Two storeys, 24 x 64, concrete foundation, reinforced concrete and pressed brick construction, felt and gravel roofing.

Store and hall, cost $6,000, 22½ Lang St., for Gordon Davies Co., Ltd. Architect, W. R. Graham. General contractor, John Hazelton. Two storeys, 35 x 70, brick front, concrete block construction, concrete foundation, fronts and fixtures, refrigerating machinery. Excavating started.

Concentrator, cost $60,000. Owners and general contractors, Northern Customs Concentrators, Ltd. All machinery except heavy stamp mortars is being built by The Wabi Iron Works, New Liskeard. Corrugated iron roofing. Walls up.

Hamilton, Ont.

Factory, cost $18,000, Bay and Vine Sts., for Duncan Lithographing Co., McNab St. S. General contractor, W. H. Yeates, Jr., 24 Leeming St. Two stys., brick and steel construction, concrete foundation. Excavating done.

Foundry, cost $125,000, Aberdeen Ave., for Canadian Westinghouse Co., Ltd. Manager, Paul J. Myler. Architects, Prack & Perrine, 36 James St. S. General contractors, H. G. Christman Co., 32 Main St. E. Two storeys, main building, 304 x 70. Foundations in.

Store, cost $5,000, King St., for B. H. Webster, Wentworth and King Sts. Architect, F. W. Warren, 808a Bank of Hamilton Bldg. General contractor, Stanley Kerr, 408 Garth St. One sty., 24 x 80. Excavating started.

Store, cost $3,700, Cannon St. Owners and general contractors, Harris & Fleming, 23 Fullerton Ave. Two storeys, 24 x 60, concrete foundation, brick construction, felt and gravel roofing, store fronts and fixtures. Permit issued.

Warehouse, cost $40,000, Bay Front, planned by Hamilton Harbour Commission. Chairman, Geo. J. Guy, 8 James St. N. General contractor, W. H. Yeates, Jr., 24 Leeming St. Reinforced concrete construction, concrete and stone foundation. Excavating done.

Ingersoll, Ont.

Soap factory, cost $11,000, for Standish Mfg. Co., Ingersoll, and 11 Colborne St., Toronto. General contractors, Nagle & Mills, Ingersoll, will sublet other trades. Excavating done.

London, Ont.

Addition to Metropolitan Hotel, cost $14,500. W. J. Wright, proprietor. Architect, J. V. Munroe, Bank of Toronto Bldg. General contractors and carpenters, Tambling & Jones, 282 Horton St. Mason, Scott Murray, King St. Roofing, J. Brownlee, 385 Talbot. Plastering, Jno. Fenn, 752 William St. Heating and plumbing, F. C. Hunt, 533 Richmond St. Electrical, Benson-Willcox Electric Co., 264 Dundas St. Three storeys, 50 x 35.

London East, Ont.

Two stores, cost $16,000, Dundas, for Heughan & Co., 1004 Dundas St. Architects, Watt & Blackwell, Bank of Toronto Bldg., London. General contractors, John Hayman & Sons, London, will do all work. Two storeys.

Montreal, Que.

Shed, cost $4,800, Amity, for Catholic Scholar Board of Montreal, 85 St. Catherine W. Architects, Venne & Labelle, 5 Beaver Hall Sq. General contractor, J. B. Martineau, 479 Orleans.

Stores and flats, cost $8,500, for A. Girard, 285 Iberville St. General contractor, L. Peltier, 255 Cartier St. Three storeys, 45 x 47, concrete foundation, felt and gravel roofing. Permit issued.

Stores, etc., cost $750,000, St. Catherine and St. Denis, for U. H. Dandurand, St. James and St. Lawrence. Architects, Ross & MacDonald, 1 Belmont St. General contractor, C. E. Deakin, 41 Mayor St. Marble, Montreal Marble Works, c/o General Contractor. Walls up.

New Hamburg, Ont.

Addition to factory, cost $15,000, for Silversmiths Co., Ltd. Mason, A. & J. Wunder, Berlin. Concrete, M. A. Fraser, New Hamburg. Three storeys, 70 x 40, brick construction, concrete foundation.

Newington, Que.

Paint shop, cost $12,000. Owners and general contractors, Quebec Central Rly. Co. General manager, J. H. Walsh, Sherbrooke. Architect, H. G. James, Whiting Block, Sherbrooke. Mechanical Engineer, Geo. Robins, Q. C. R. Shops. Work done by day labor. Iron and steel, Jenckes Machine Co., Sherbrooke. One sty. and monitor, 175 x 62, cement foundation, structural steel and red brick construction, felt and gravel roofing.

Ottawa, Ont.

Factory, cost $14,000, Aberdeen. Owner and architect, M. J. O'Brien, Raglan St., Renfrew. General contractor, A. E. Spooner, Windsor House. Two storeys, Walls started.

Addition and alterations to stores, cost $5,000, Rideau, for E. C. Grant and H. P. Fleming, Elgin St. Architect, C. J. Burritt, 193 Sparks St. General contractor, Alex. Christie, 359 Elgin St.

Business block, cost $100,000, for Mrs. Cowie, Albert St. Architect, C. P. Meredith, 126 Sparks St. Mason, T. C. James, 140 Flora St. Excavating started.

Addition to stores, cost $250,000, Rideau and Essex St., for A. E. Rae Co., Ltd., Rideau St. Architects, Ross & MacDonald, 1 Belmont St., Montreal. General contractors, Doran & Delvin, Sussex St. Walls partly up.

Addition to warehouse, cost $10,000, for S. J. Major, Ltd., York St. Architect, C. P. Meredith, 126 Sparks St. General contractor, T. C. James, 104 Flora. One storey addition, brick and reinforced concrete construction, electric lighting.

Regina, Sask.

Addition to warehouse for Regina Plumbing & Heating Co., Ltd., Hamilton St. Architects, Storey & Van Egmond, Credit Foncier Bldg. General contractors, Minkley & Traub. Three storeys, stone and brick construction, felt and gravel roofing, electric lighting. Foundations in.

Stable, cost $23,900, Albert, planned by City Council. Architect, R. W. Allen, City Engineer's Office. General contractors, Frid Lewis & Co., Ltd., 901 Somerset Bldg., Winnipeg. Plumbing and heating, Paulin & Swayze, 1778 Rose St. Interior fittings, Economy Foundry Co., 619 Somerset Bldg., Winnipeg. Two storeys, stone, frame and brick construction.

Sault Ste. Marie, Ont.

Stores and offices, cost $8,500, for T. T. Barnes, Queen St. Architects, Moran & McPhail, Queen St. General contractors, Ableson & Wright. Plumbing, F. H. Barnes, 344 Queen St. Two storeys and basement, 58 x 27½, brick construction, stone foundation. Excavating done.

Stores and residence, cost $12,000, Queen St., for S. W. Fawcett, 148 Church St. Architects, Moran & McPhail, Queen St. General contractors, Ableson & Wright. Two storeys and basement, 60 x 27½.

St. John, N.B.

Grain elevator, cost $500,000, West, for C. P. R. Co. General manager, F. R. Hodge, Montreal. General contractors, Jno. S. Metcalf Co., Montreal.

Bank, cost $50,000, Market Sq., for Bank of British North America. Architect, G. E. Fairweather, 84 Germain St. General contractors, B. Mooney & Sons, 112 Queen St.

Stratford, Ont.

Addition to factory, cost $25,000, Erie, for Can. General Electric Co., King and Simcoe Sts., Toronto. Local manager, W. Preston. Architect, J. S. Russell, 21 Downie St. General contractor, J. L. Youngs. Work done by day labor. Three storeys, 50 x 161. Foundations in.

Toronto, Ont.

Stores and residences, cost $16,000, 1395 Queen St. W. Owners and general contractors, Weistmiller & Mackenzie Bros., 1431 Queen W. Owners superintend all construction. Three storeys, 70 x 56, brick and steel construction, stone foundation, felt and gravel roofing, store fronts and fixtures. Foundations started.

Windsor, Ont.

Factory (2nd building), cost $50,000, Tecumseh Road, for Remington Arms Co. Engineer, W. G. Haycock. General contractors, Wells & Grey. One storey, 144 x 96, brick and steel construction, concrete foundation. Excavating done.

Alterations to Chinese restaurant, cost $3,500, Sandwich St. W., for King Lee, Chatham. Architects, G. Jacques & Co. General contractor, Rollo Westcott.

Winnipeg, Man.

Bank building, cost $25,000, Main St. N., for Merchants Bank of Canada. Architects, J. D. Atcheson & Co., Trust and Loan Bldg. General contractor, Geo. A. Fuller, Union Bank Bldg.

Factory, cost $3,000, Selkirk avenue. Owners and general contractors, Manitoba Vinegar Mfg. Co., Selkirk ave. Two storeys, 40 x 70, frame construction, felt and gravel roofing, steam heating. Foundations in.

Residences

Montreal, Que.

12 flats, cost $10,000, Rosemount (2nd Ave.), for Trudeau & Laframboise, 182 St. Catherine E. Architects, Audet & Charbonneau, 15 St. James St. Plans to be drawn this winter and tenders called in spring.

10 cottages, cost $40,000, Cote St. Michael (Back River Road). Architect, S. Frappier, 2238 Park Ave. Plans will be ready to call for tenders about Nov. 20th. Tenders received for two cottages at once. Concrete foundation, frame construction, felt and gravel roofing.

Residence, cost $5,000, Outremont (Outremont), for P. P. Boileau. Architect, S. Frappin, 2238 Park Ave., Montreal. General contractor, C. Mathieu, Fort William. Plans will be ready to call for tenders about Dec. 1st. Two storeys, 29 x 52, concrete foundation, stone and brick construction.

Residences, cost $20,000, Outremont (Querbes St.), for M. Dagenais, 1055 Laurier Ave. W. Architect, L. R. Montbriant, 230 St. Andre St., Montreal. Plans ready.

Five flats, cost $7,000, Majuenesse St.. for Mrs. Helen Turgeon, 1048 Cremajie. Three storeys, 45 x 47, concrete foundation, felt and gravel roofing. Permits issued.

Residence, cost $23,000, Westmount (Carleton), for J. E. Dalrymple, 4684 Western Ave. Architect, A. K. Hutchon, 702 New Birks Bldg. Owner is now receiving tenders for general contract.

Residence, cost $25,000 Outremont St. Catherines Rd.), for A. A. Grothe, 141 Villeneuve W. Architect, Chas. Chausse, 17 Pagnuelo Ave. Foundation, Martineau Pisson & Laurence, Berri St. Foundation to be put in this fall. Other contracts to be awarded in spring. Three storeys, 41 x 50, concrete foundation, waterproofed, stone and brick construction, felt and gravel roofing.

Six flats, cost $7,000, Rozel, for Wilfrid Girard, 75 Shearer. Three storeys, 51 x 40, concrete foundation, felt and gravel roofing. Plans ready.

Montreal West, Que.

Semi-detached cottages, cost $10,000, for W. S. P. Burns, care Architects, Benoit & Girard, 215 St. Catherine W. Two storeys, 56 x 32, concrete foundation, brick veneer construction. Plans in progress.

Ottawa, Ont.

Residence, cost $4,900, Ossington, for H. L. Morrison, 41 Somerset St. 2½ storeys, stone foundation, brick veneer construction. Plans in progress.

Residences, cost $4,500 each, Munro St. Owners and architects, Messrs. Willis & McDonald, Munro St. 2½ storeys, concrete and stone foundation, brick veneer construction, felt and gravel roofing. Plans in progress.

Residence, cost $5,000, Rideau. Owner and architect, S. Coplan, 282 Murray. Stone foundation, brick veneer construction. Plans ready.

Two residences, cost $10,000, Stewart. Owner and architect, S. Copland, 282 Murray. Stone foundation, brick veneer construction, shingle and felt and gravel roofing. Excavating started.

Residence, cost $7,500, Powell. Owner and architect, A. E. Shaver, 45 Powell Ave. 2½-storeys, 32 x 38, brick veneer and rough-cast construction, stone foundation. Plans in progress.

Residence, cost $7,000, Driveway. Owner and architect, A. E. Shaver, 45 Powell Ave. Stone foundation, rough-cast and brick veneer construction. Plans in progress.

Residence, cost $12,000, Clemow, for John Foley, Central Chmbrs. Solid brick construction, stone and concrete foundation. Plans in progress.

Residence and garage, cost $15,000, Clemow. Owner and architect, W. E. Noffke, Central Chambers. 2½-storeys. 39 x 48, brick veneer construction, stone and concrete foundation. Plans drawn

Residence, cost $5,500, Regent, for Geo Wilson, 341 Gloucester St. 2½-storeys, 34 x 46, double brick veneer construction. stone foundation. Plans will be prepared.

Regina, Sask.

Rectory, cost $7,500, 14th and Winnipeg, for Grace Church. Pastor, E. C. Earb, 2360 Smith St. Architects, Clemensha & Partnell, Scarth St. 2½-storeys, 9 rooms, red pressed brick construction brick foundation. Plans drawn.

Apartment block, cost $40,000, 14th and Robinson, for G. F. Warde, Modern Apartment Block. Five storeys, brick and stone construction, brick foundation Plans ready.

Twp. Sandwich East, Ont.

Residence, cost $14,000, Walker Road for Frank Walker, Walkerville, Ont Tenders received by Architects, Stohl & Kinsey, Walkerville, until Nov. 20th. 2½-storeys, 30 x 60, frame construction, cement foundation.

Toronto, Ont.

Residence, cost $5,000, Thorburn, for J. M. Cowan (in trust), 65 Adelaide E.

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Two storeys, 32 x 44, brick construction, stone foundation, felt and gravel roofing. Plans drawn.

Windsor, Ont.
Two-family flat, cost $7,500, Giles Ave., for Peter Osterhout. Architects, Leybourne & Whitney. Two storeys, frame and stucco construction. Plans in progress.

Residence, cost $15,000, Victoria, for C. A. Smith. Architect, J. C. Pennington. Two storeys, 68 x 34, hollow tile construction. Plans in progress.

Winnipeg, Man.
Residences, cost $200,000, contemplated by a Syndicate. Interested, C. W. N. Kennedy, Kennedy Bldg. Houses to be erected to cost from $1,500 to $2,000 each. Owners intend building 102 in 1914 and 102 before 1916.

CONTRACTS AWARDED

Hamilton, Ont.
Three residences, cost $10,000 each, Inglewood Drive, for S. McPhie & L. Donaldson, 701 Bank of Hamilton Bldg. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Carpenter, Donaldson & Patterson, 229 Bay St. S. Foundations in.

Medicine Hat, Alta.
Residence, cost $4,600, Barclay St., for W. A. Radcliffe (Manager, Dominion Bank). Architects, Bourne & Morrison, Huckvale Block. General contractor, Jno. E. Stacey, 815 Alberta St. Two storeys, 28 x 32, frame construction Foundations in.

Montreal, Que.
24 flats, cost $24,000, Westmount (Western Ave.) Owners, architects and gen. contractors, G. N. Clermont & Co., 97 St. James St., Montreal. Work done by day labor. Three storeys, 195 x 50, felt and gravel roofing, stone and brick construction, lime and sand plaster. Foundations in.

Residence, cost $25,000, Outremont (St. Catherine Rd.), for J. W. Jalbert, 189 Villeneuve W. Architect, Chas. Chausse, 17 Pagnuelo Ave. Foundation, Martineau Pisson & Laurence, Berri St. Foundation to be put in this fall. Other contracts to be awarded in spring. Three storeys, 38 x 54, concrete foundation, waterproofed, stone construction, felt and gravel roofing. Excavating done.

Residence, cost $16,000, Westmount (Mountain St.), for Ryan Tetley, 78 Crescent St., Montreal. Architect, H. Strang, 4550 St. Catherine. Mason, Chas. Robillard, 2397 Drolet St. Heating and plumbing, Hart & O'Brien, 241 Mentena St. Other contracts to be let shortly. Two storeys, 57 x 51. Excavating done.

Ottawa, Ont.
Residence, cost $5,500, 3rd Ave., for Wm. Moxley, c/o Builder and general contractor, A. C. Burton, 509 McLeod St. Brick veneer construction, stone foundation.

Quebec, Que.
Residence, cost $14,000, Moncalmville (De Bougainville), for Ulric L'Heureux, Ste. Foye. General contractor, mason, carpenter, plastering, painting and interior fittings, J. Breton, 175 St. Olivier. Roofing, heating, plumbing and electrical, P. Paradis, 236 d'Aiguillon. Three stys., 50 x 30, concrete foundation, Scotch brick construction. Excavating done.

Residence, cost $8,000, Lockwell, for Mrs. A. Parent, 62 Desprairies. General contractor, C. A. Vezina, 61 Desprairies. Mason, carpenter and plastering, Ed. Belanger, 185 Ste. Marguerite. Other contracts not yet awarded. Two storeys and basement, 36 x 34, kitchen 20 x 12, concrete foundation, red and Scotch brick construction.

Toronto, Ont.
Four pair residences, cost $16,000, Castlefield ave. Owner, general contractor, masonry and carpentry, Citizens Home Construction Co., 2261 Yonge St. Architect, W. H. Mallory, 31 Queen W. Supt. of construction, Jno. Whitehead, 28 Carlton. Roofing, plastering, painting, heating, plumbing, electrical, to be sublet. 32 x 40, brick construction, brick foundation.

Residence, cost $4,900, Roehampton Ave., for A. S. Anderson, 14 Glenwood. General contractor, E. C. Brown, 87 Sherwood Ave. Two storeys, 24 x 36, brick construction, brick foundation. Excavating started.

Vaudreuil, Que.
Residence, cost $25,000, for L. Chaput, 2 De Bresoles St., Montreal. Architects, Viau & Venne, 76 St. Gabriel St., Montreal. General contractor, Mr. Hamilton, Vaudreuil. Three storeys, 40 x 50. Ex-

Winnipeg, Man.
Residence, cost $8,000, Elm St. Owners and general contractors, Purcer Bros., 509 McIntyre Block. Two storeys, 28 x 30, frame construction. Foundations in.

Residence, cost $6,000, Oak. Owners and general contractors, Andrews & Sons, Portage and Victor. Two storeys, 28 x 30, frame construction, stone foundation. Excavating done.

Power Plants, Electricity and Telephones

Brantford, Ont.
The Municipal Councils of Grandview, Elmo Place, Paris Hill and Parkdale, have petitioned the Ontario Hydro Commission for power.

Brockville, Ont.
Manager, E. J. Philip proposes to instal new retorts and other equipment at the local gas plant. Estimated cost $40,000. Town Council (Water and Light Dept.). Chairman, C. S. Cossitt.

Elora, Ont.
Hydro power contemplated by Village Council. Clerk, Henry Clarke. Council given power to spend $10,000. Transformer station will be located between Fergus and Elora. By-law carried.

Fergus, Ont.
Council has been given power to spend $16,000 on a complete Hydro-electric System. Transformer station will be located between Fergus and Elora. Clerk, James Beattie.

Ottawa, Ont.
Theatre, cost $40,000, for H. Brouse, Bank St. Architect, H. Herbert George, Castle Bldg., Queen St. Mason, A. Tubbe, 72 Lees Ave. Plans for interior decoration required by architect, also designs. Excavating done.

Strome, Alta.
Stores burned. Owners, Douglas Bros., general store, loss $27,000, insurance, $15,000; Strome Pharmacy, E. H. Hayman, $7,000, insurance, $3,000; Strome Restaurant, P. Dick, $6,000, insurance, $4,000; Miss B. C. Hite, millinery store, $3,000; F. C. Freeman, pool room, $3,000.

St. Catharines, Ont.
Sub-station, etc., cost $116,000, planned. Clerk, J. A. Pay. Engineer, W. P. Near, City Hall. Transformer houses and transformers required, to be provided by the Council.

Swift Current, Sask.
Power house, cost $9,310, planned by Town Council. Sec.-Treas., G. D. Arnott. Elec. Supt., A. V. Ross. Engineer, G. D. Mackie. General contractors, Gillstorm Contracting Co., Cheadle St. W.

Toronto, Ont.
Chapel, 97 St. Joseph St., for Roman Catholic denomination. Architect, A. W. Holmes, 10 Bloor St. E. Mason, J. McGlue, 285 Sherbourne. Carpenter, T. J. Sullivan, 552 Ontario St. Two storeys, 35 x 75, brick construction and foundation. Chapel to be erected in connection with Newman Hall. Excavating started.

Winnipeg, Man.
Residence, cost $4,000, Polson ave. Owner and general contractor, D. Silvert, 315 Flora ave. Two storeys, 24 x 28, frame construction. Foundations in.

Tenders received by Board till Dec. 11th, for year's supply of d.c. and a.c. electric induction meters. Specifications, etc., at office of Engineer. J. G. Glassco, 54 King Street.

At the forthcoming municipal elections the ratepayers will be asked to vote on a by-law to raise one million dollars for extensions to the light and power system. Of this amount the new transmission line will cost approximately $500,000. The type of transmission line recommended is a combination of braced and flexible towers with approximately twelve flexibles between each two, braced and spaced four hundred feet apart, thus placing a braced tower at each mile. The type of tower to be used will not be decided upon until the tenders are in. Tenderers will be asked to submit alternative bids and the type adopted will depend largely upon the result of specified tests. Tenders for the towers will not be called until the spring, but contractors will shortly be asked to tender upon the work of piling and other labor in connection with the preparation of the right-of-way. This tower line is to be carried along the right-of-way of the present 60,000-volt line, which is approximately 75 miles long and will be designed to carry two 110,000-volt lines with suspension type insulators.

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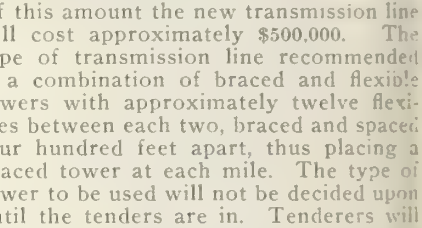

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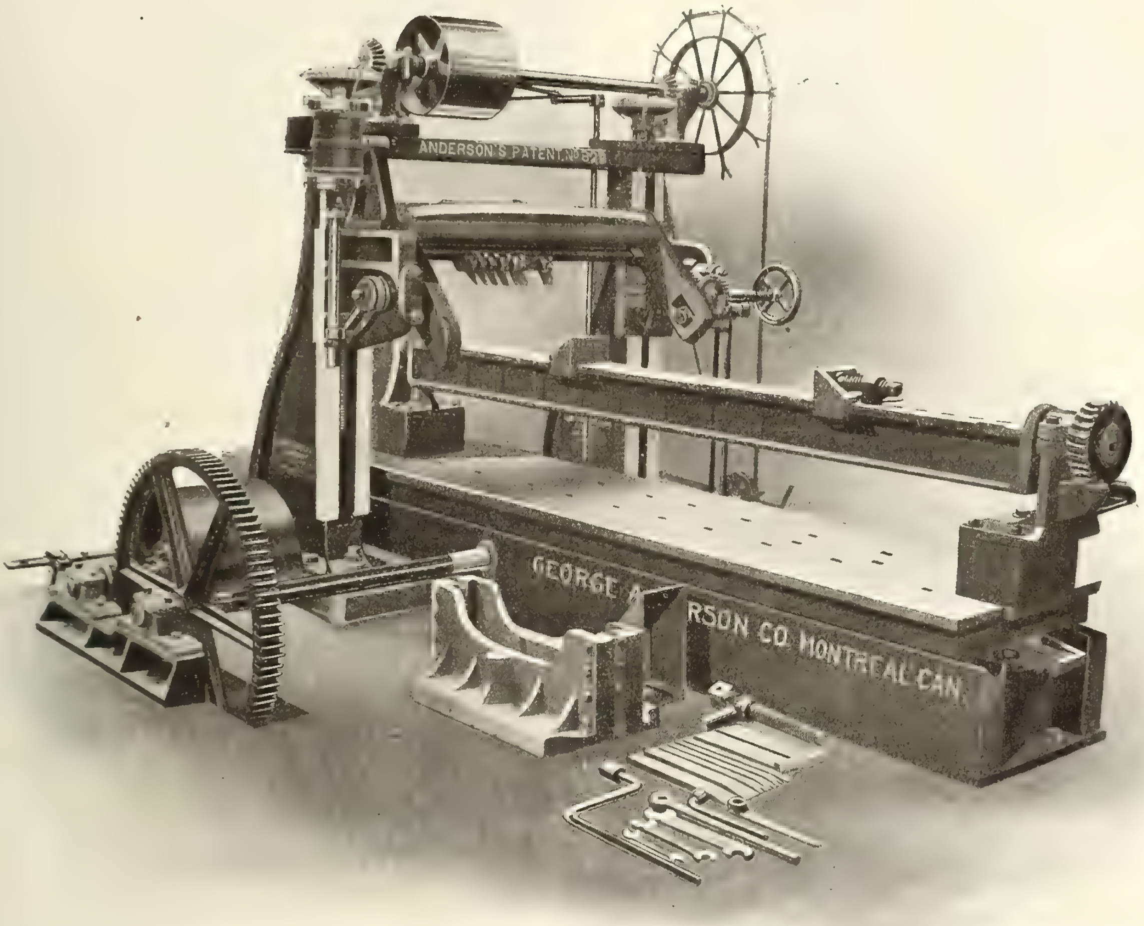

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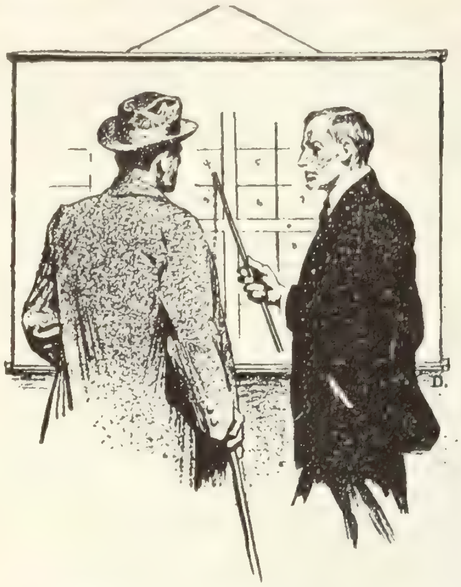

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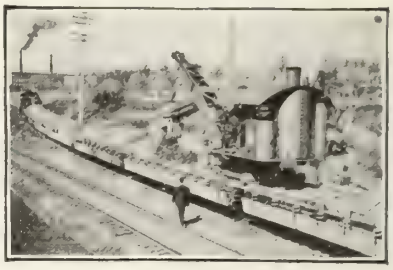

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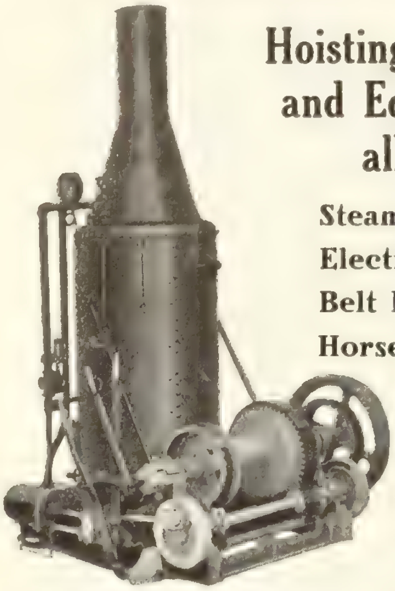

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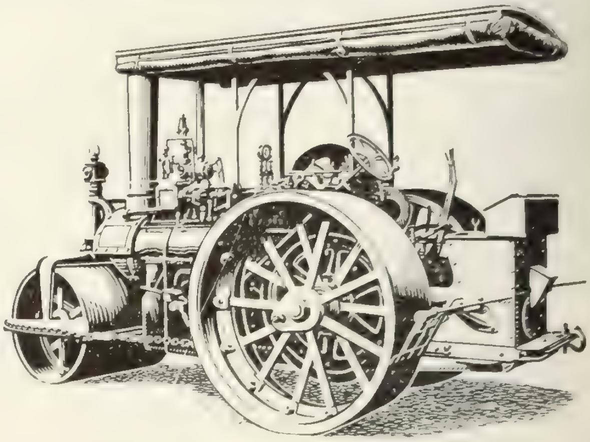

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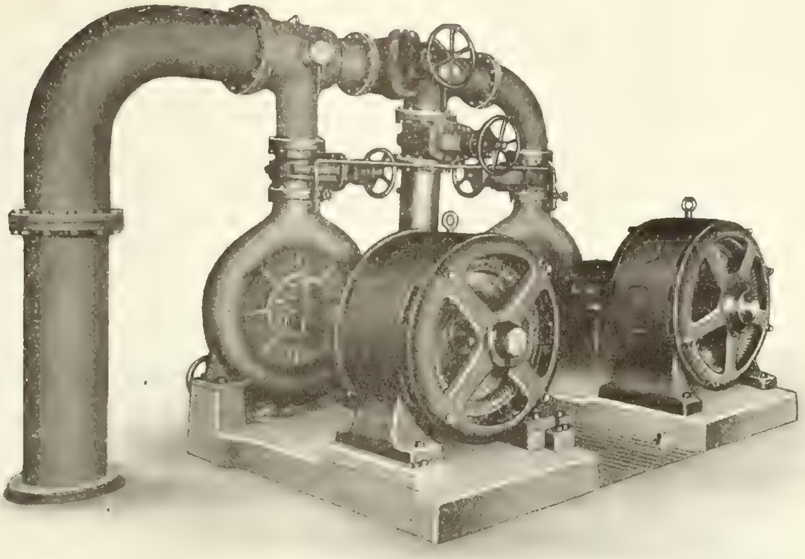

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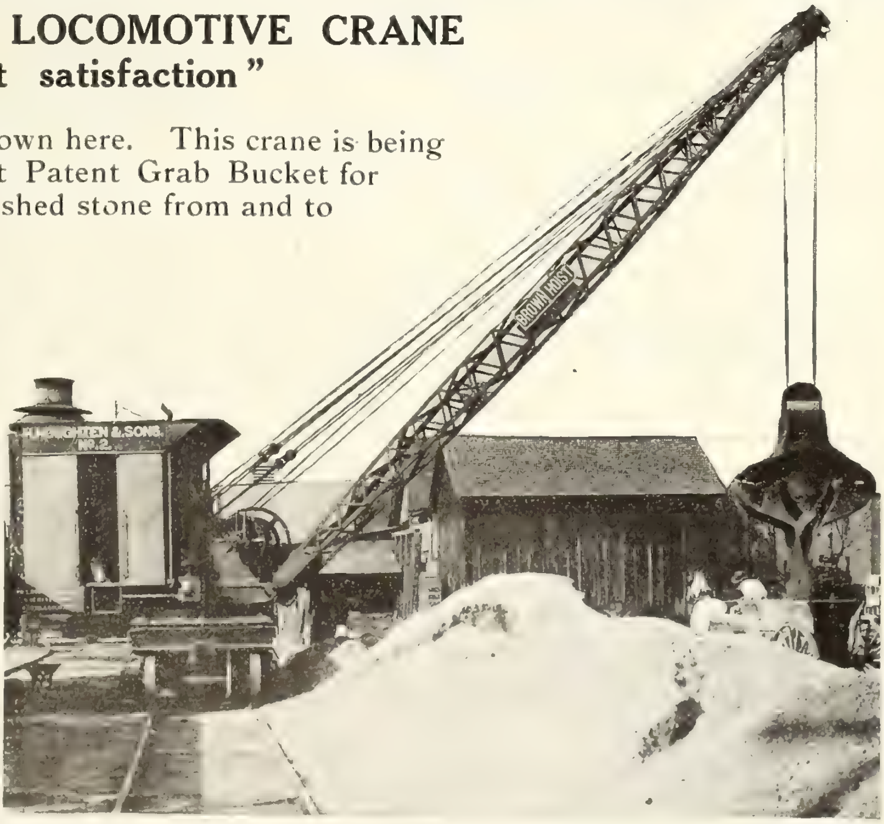

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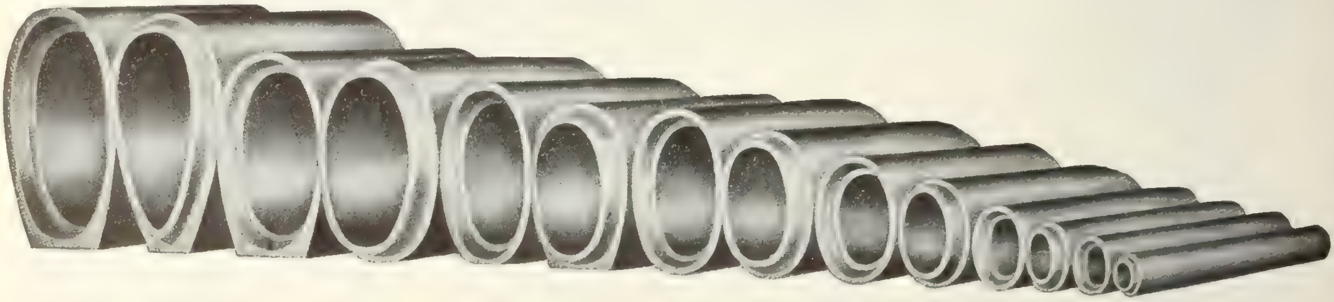

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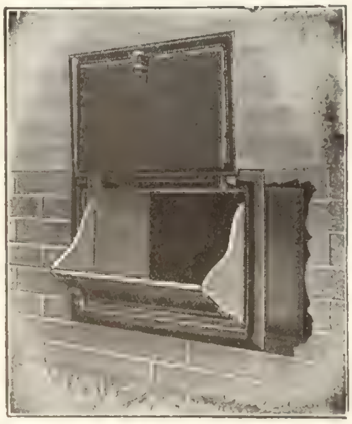

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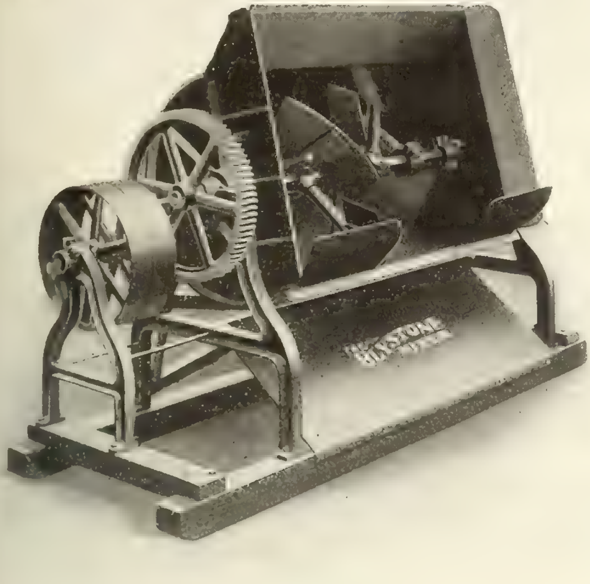
Montreal Representative: E. F. Dartnell, No. 8 Beaver Hall Square
Gorman, Clancey & Grindley, Agents, Calgary and Edmonton, Alberta

The Best Service at Lowest Cost



The Blystone Skid Mixer

The perfect design and construction of this mixer reduces the working cost to a minimum and effects the greatest ease in operation. All working parts are strongly made and will not get out of order.

Easy to work—Easy to Clean High efficiency—Low cost

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The Blystone Machinery Company

82 Railroad St., CAMBRIDGE SPRINGS, Pa., U.S.A.

Full line of Blystone Mixers carried in stock by

The A. R. Williams Machinery Co., Limited, Toronto, Ont.
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Gorman, Clancy & Grindley, Calgary, Alberta.
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"Metallic"

"Hayes" Patent Lath

in steel, overcomes certain objections to expanded and other types of metal lathing, as it has extraordinary stiffness and strength, and gives a perfect bond for plaster. It maintains plaster positively under fire and water, and is itself a barrier to fire. For plaster work or backing tile, and for the best fireproof construction, with easy application to walls and ceilings, our "Hayes" Patent Steel Lath stands alone.

It will pay you to learn all about "Hayes" Patent Steel Lath, made on our modern machines. It makes economical and easy construction, using lime or cement plaster.

THE METALLIC ROOFING CO.
OF CANADA LIMITED,
TORONTO AND WINNIPEG

Contractors' Acetylene Flare Lights

Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

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1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

Price F.O.B. Ottawa $65.00.

Manufactured by

International Marine Signal Co. Limited
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FOR SALE

- 1, 10 x 16 Slidevalve Engine
- 2, 40 H.P. Tubular Boilers
- 1, 10 Ton Derrick Complete
- 1, 30 H.P. Dick Kerr Motor
- 1, 40 H.P. Bullock Motor
- 2, 2 H.P. 2 Phase Motors
- 1, No. 5 Pulsometer Pump (New)
- 1, 1/2 Yard Milwaukee Concrete Mixer
- 1, 7 x 10 Blake-Marsden Crusher
- 1, Pair 5 Foot Edge Rolls
- 1, No. 3 Gates Crusher with Elevator and Screen Complete
- 1, 6″ Morris Sand Pump Steam Connected
- 1, 7 x 12 Beatty Hoist with Swinger
- 1, No. 4 Champion Stone Crusher
- 1, 6 x 3 x 7 Cameron Sinker
- 1, Buckeye Trench Excavator

The above machines are but slightly used and are in good working order.

Fleming Machinery Company
340 Sparks Street, Ottawa, Can.

STANDARD FIRE-PROOF DOORS

INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

ALL OUR DOORS AND HARDWARE ARE LABELLED BY THE UNDERWRITERS.

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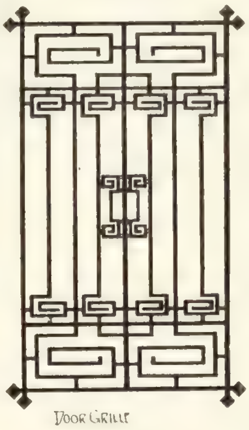

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We execute Architects Designs in Wrought Iron, Bronze or Brass.

The workmanship and finish of our grill work is of high standard.

We illustrate a number of designs in our Catalogue that offer useful suggestions.

Dennis Wire & Iron Works Co.
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Toronto Branch : 36 LOMBARD STREET

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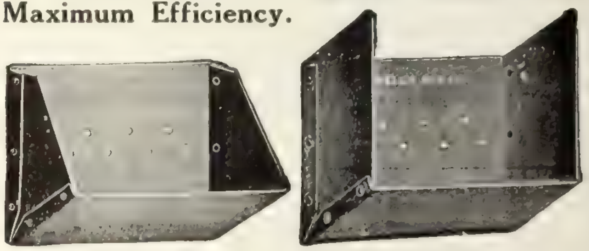
Every Weller Hand Is Expert

"Weller" on Machinery is a Guarantee to Highest Quality and Maximum Efficiency.



Your Elevating, Conveying and Transmission problems are **lightened**, the costs **reduced** and a considerable amount of time is saved. It's economy from all angles with **efficiency** predominating **throughout**.

Weller Shipments are prompt too, and cooperation distinctive of the Weller Service exists at all times. Suggestions and estimates on request.

Elevator Buckets, Portable Elevators, Dump Cars, Power Shovels, Belt and Spiral Conveyors, Etc.

Write for our catalog No. 20, free on request

Weller Mfg. Co., Chicago
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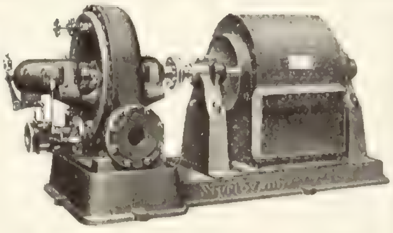
Sturtevant
(REG. U.S. PAT. OFF.)
Steam Turbines



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STURTEVANT Steam Turbines are simple, reliable, and always ready. They show exceptionally low steam consumptions in actual operation. They are especially adapted for driving fans, centrifugal pumps, and electric generators. Used by the New York Edison Company, the Indiana Steel Company, and other large corporations after thorough investigation of all competing machines.

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Eastern Sales Office 919 New Birks Bldg., Montreal
Selling Agents for Sanford Riley Stoker Co., Ltd. No. 996

Use Buffalo Pitts Co.
Traction Trains and Haulage Outfits

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SAND AND LIME BRICK

Absolutely the best in the city.
Daily capacity of plant: 40,000.
Uniform in size, color and quality.
Free from bats and culls.
High crushing test.

PROMPT DELIVERIES

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Telephone or write for samples and quotations.

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OFFICE: 123 Bay St.,
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GYPSUM HOLLOW TILE

The New Modern Method of Fireproofing

Very Light,
Easy to Install,
Holds nails, screws, etc.
Best non-conductor of heat,
Costs less than clay hollow tile,
Sound Proof.

Send for Catalogue and Price.

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Prompt Shipment

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FOR QUOTATIONS ON

Lime, Stone, Cement, Sewer Pipe, Fire Brick, Weeping Tile, Mortar Colors, Plaster, &c.

Toronto Agents for

OWEN SOUND CRUSHED STONE

Deliveries—G.T.R. and C.P.R.

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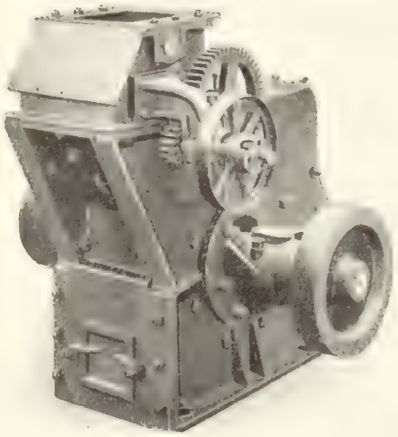
Phones, Junct. 828 and 829

Branch Yards, 53 Merton St.
Phone, North 4751 G.T.R Belt Line
Night and Sunday calls, Phone Junction, 3333.

THE PULVERATOR

A crushing and pulverizing machine designed on a new principle.



Pulverator.

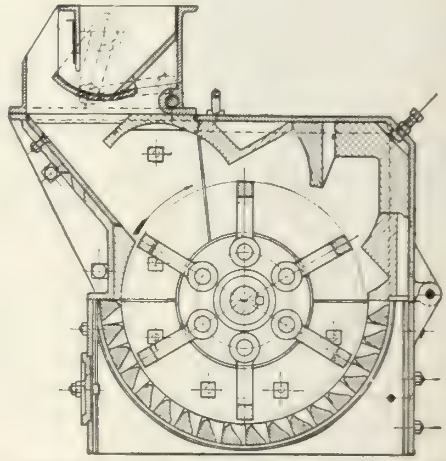
USES

It is designed as a crusher for the reduction of material from 3 inches or finer to a size of which all will pass a 20-mesh screen if necessary. The materials which it handles to advantage include limestone for cement making, concrete, agricultural purposes, etc., coal shale, felspar, phosphate rock, gypsum, beauxite, slag and similar substances.

The capacity is proportional to the size of the product and the character of the feed. It varies from 6 to 7 tons an hour up to 15 tons, with consumption of a corresponding amount of powers, ranging from 25 to 40 H.P. for the outputs mentioned.

OPERATION

The material is fed into the machine by a feeder or feed spout located in one of the upper corners and is immediately struck upward by one of the swiftly revolving hammers. It is thrown against the involute surface of the liners, which are set at such an angle that the material re-bounds and is again struck by the hammers, this action being repeated until the material is finely pulverized. The fine material is carried forward by the air currents and passes out between the involute liners or grate bars in the bottom of the casing. The hammers revolve very rapidly and are sufficiently heavy to produce a very effective blow even on a large lump of material.



Cross-Section of Allis-Chalmers Pulverator (Patented).

See Bulletin 4028

CANADIAN ALLIS-CHALMERS, LIMITED

Head Office: KING AND SIMCOE STS., TORONTO

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Contractors who buy numbers of Hoists usually have to be convinced that what they are getting is "O. K."

The closer they examine and watch BEATTY HOISTS under severest conditions — the better pleased they are.

Their use spells SATISFACTION.

The reason? The material, design and workmanship "are there."

We are building for the future—both yours and our own.

If you place one BEATTY HOIST on your work, you'll eventually buy more.

Will gladly send full particulars and catalog.

DIPPER DREDGES
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All carry our equipment in stock.

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WOODEN WATER PIPE

For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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802 McGILL BUILDING, MONTREAL **Works: ALEXANDRIA, ONT.**

The Maritime Bridge Company, Limited

Successors to

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Manufacturers of

Bridges—Steel Buildings
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of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

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MR. CONTRACTOR!

Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

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THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.

LIMITED

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Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

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Head Office:
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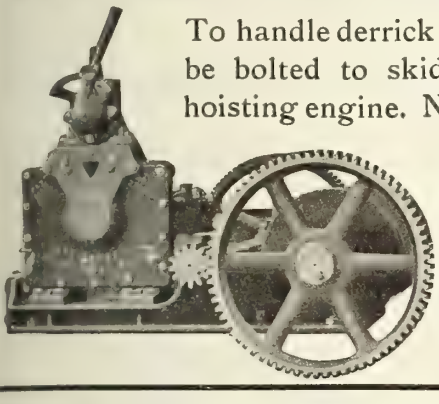
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The Dake Swinging Gear



To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

Start, Stop, Reverse at Will

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Grand Haven, Mich.

When you want stone that appeals specify

"Queenston Blue" Limestone

Send us your specifications for Cut Stone work

The Queenston Quarry Co., Ltd.
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Hard Wall Plaster

Manufactured by

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Limited
100 Bleury Street - - MONTREAL

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for Interior Construction

Conduits Company, Limited
Sole Manufacturers under Canadian and U. S. Letters Patent
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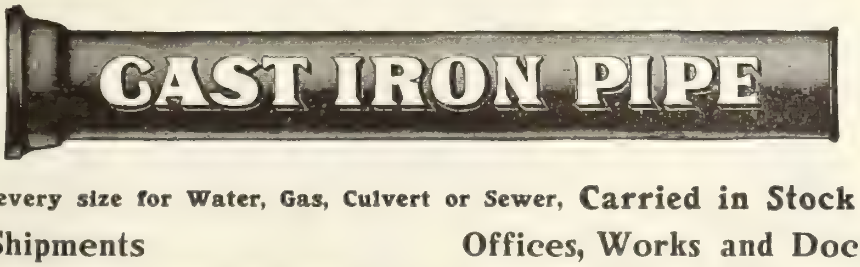
LARGEST MANUFACTURERS IN CANADA OF



every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments Offices, Works and Docks, TORONTO

Erected at Seven Falls, Quebec, Distributor Pipe and Branches, under 450 ft. Head.

Structural and Steel Plate Work

is our specialty, We fabricate and erect from your drawings, or will design your structure for you.

No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

WALSH PLATE & STRUCTURAL WORKS, LIMITED

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Block, Sawed, Planed
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THE H. & E. PATENT BALL-BEARING LIFTING JACK

For Railway and Bridge Work, Contractors' and Builders' Use

Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

Manufactured by

CANADA LIFTING JACK CO., LTD.
(Formerly the H. & E. Lifting Jack Co.)
WATERVILLE, QUE.

Stock carried by F. H. Hopkins & Company, Montreal

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.07

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

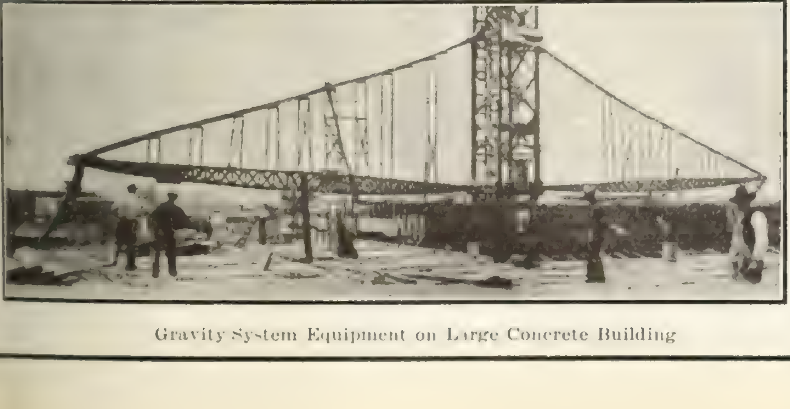
Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

Gravity System Distributing Concrete



Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.

Sole Licencees for Canada

613 Vancouver Block,
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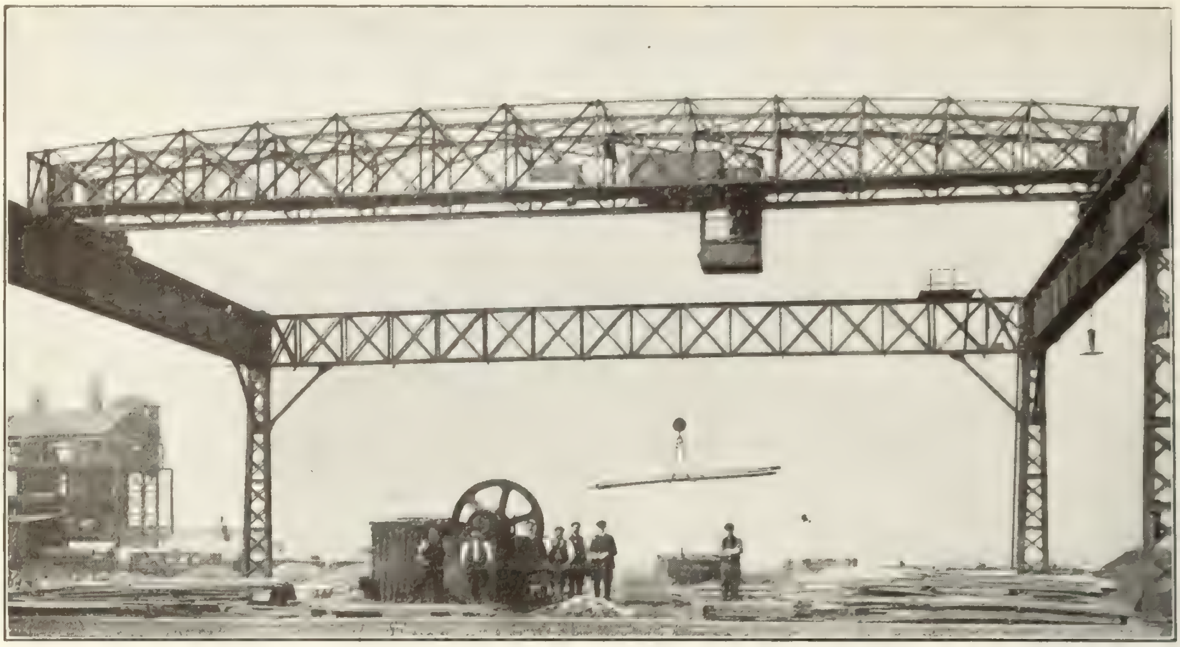
Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.



Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

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Cranes
Capstans
Telfers
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*Include
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Crane Type
Motors,
Controllers,
Over
Hoisting
Safeguard.*

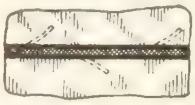
YOUR ENQUIRIES ARE SOLICITED FOR

CRANES TELFERS CAPSTANS WINCHES

ROYCE, LTD., Trafford Park, Manchester, England

Send for This Book on Concrete Pavements

Our booklet on concrete pavements illustrates and describes pavements in many different cities, giving cost data and describing in detail the methods used. Complete specifications for the ideal concrete pavements are included as well as instructions for installing Baker plates. This booklet is sent without charge to responsible engineers contractors and highway officials.



Longitudinal Section Showing Joint.

Cross-Section of Pavement Showing Expansion Joint.

Baker Armor Plates

Protect Your Concrete Pavement at its Weakest Point—the Expansion Joint

Wayne County's 70 Miles of Concrete Roads Prove that the Baker Plate Has Solved the Expansion Joint Problem.

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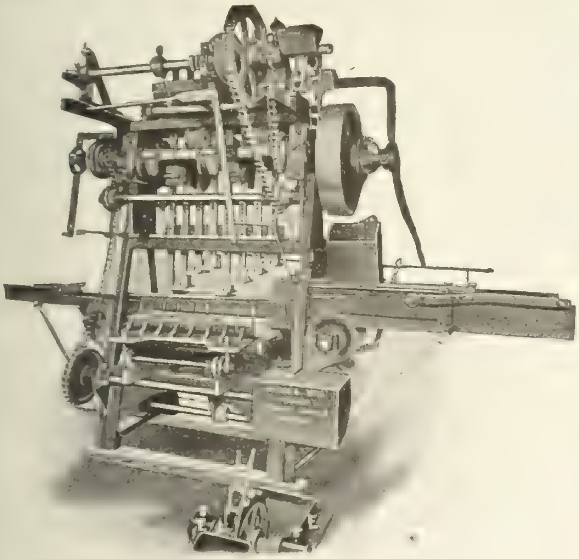

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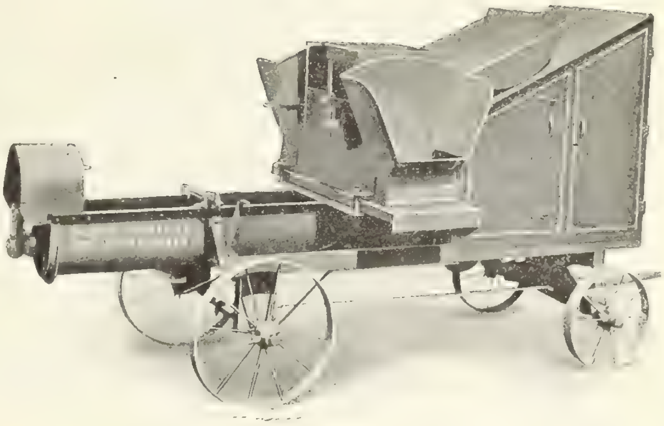

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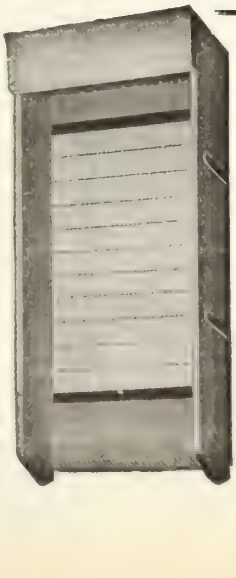

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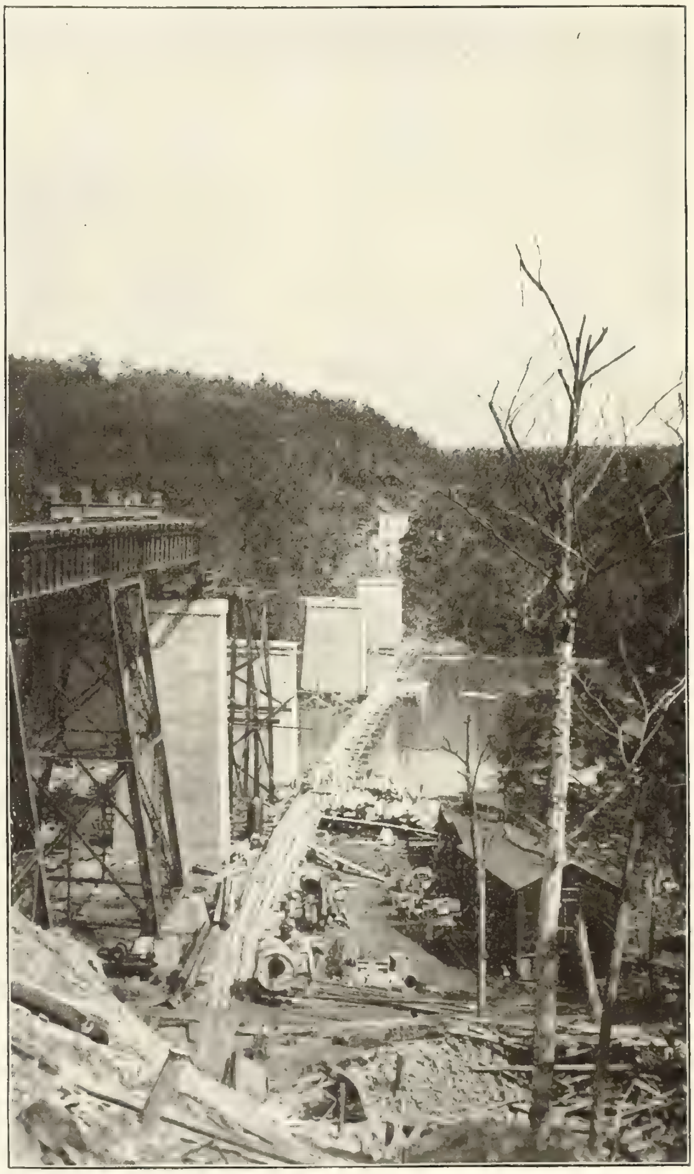

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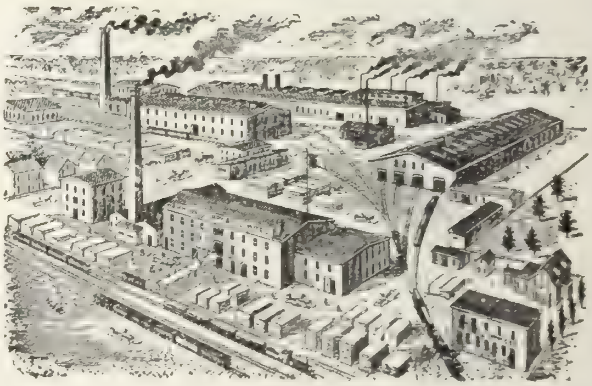

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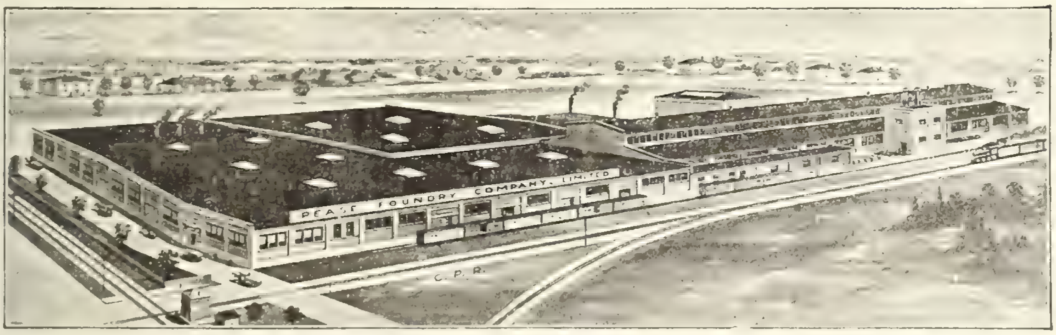

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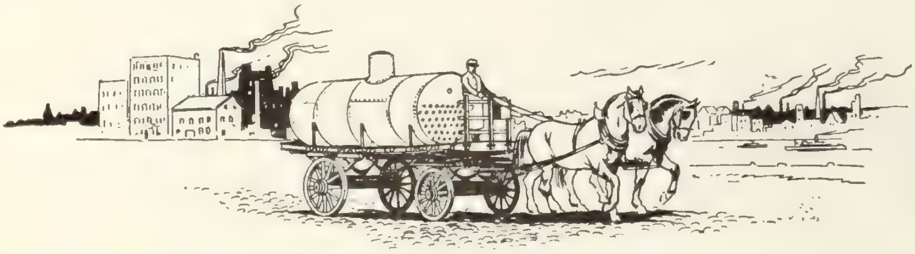

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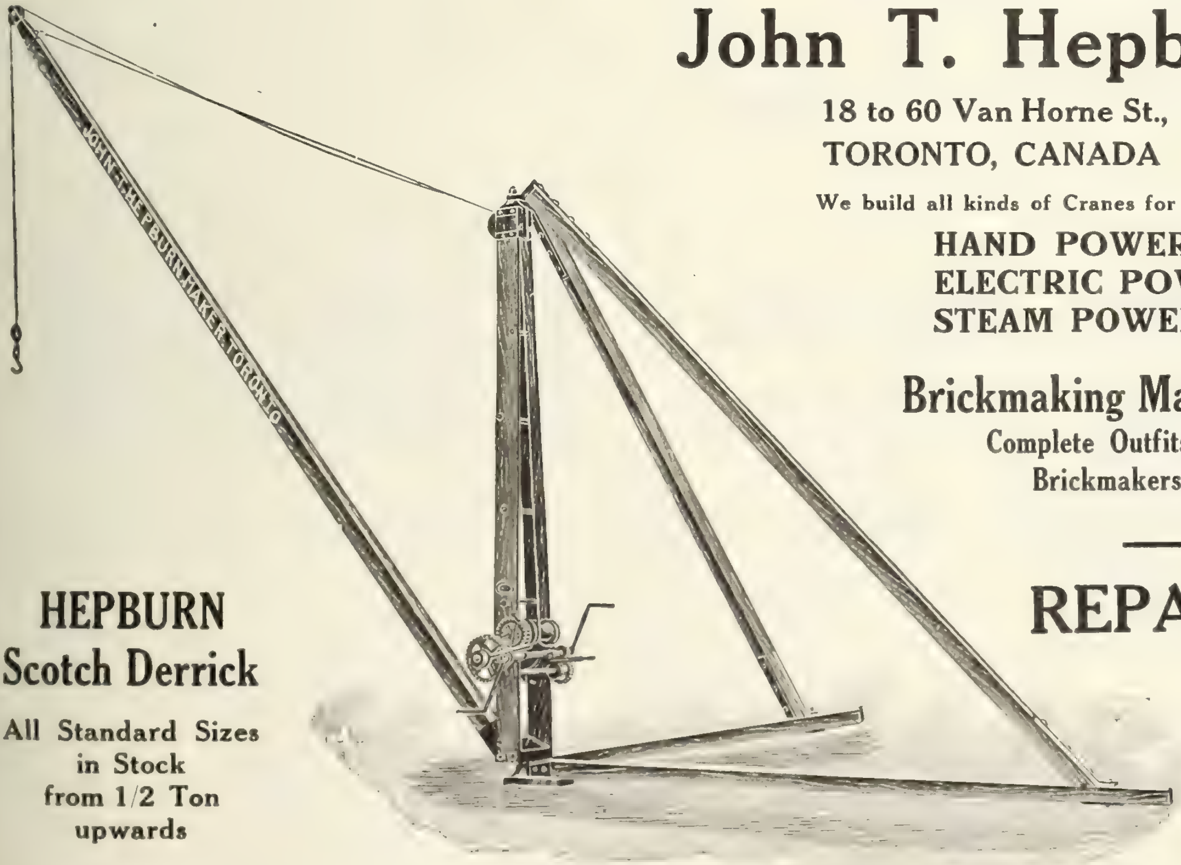
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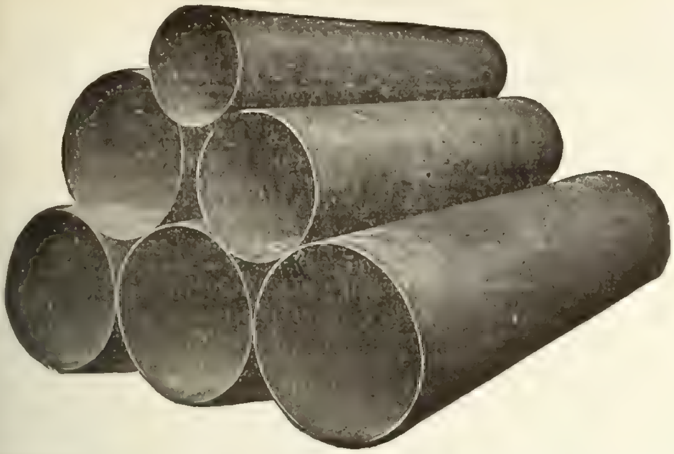

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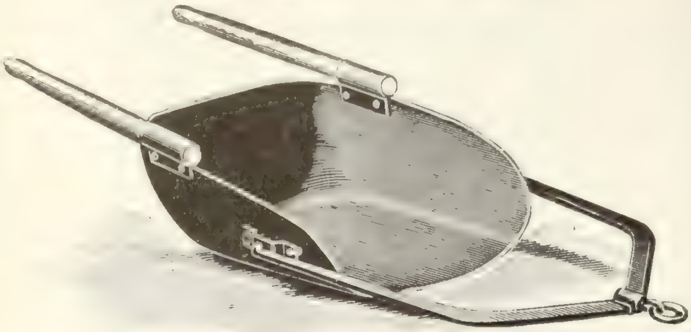

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Head Office Phones: Main 5472—5473

"EBANO" and "EAGLE" Brands

MEXICAN ASPHALT

HERKIMER ST., HAMILTON. Paved with our Mexican Asphalt.

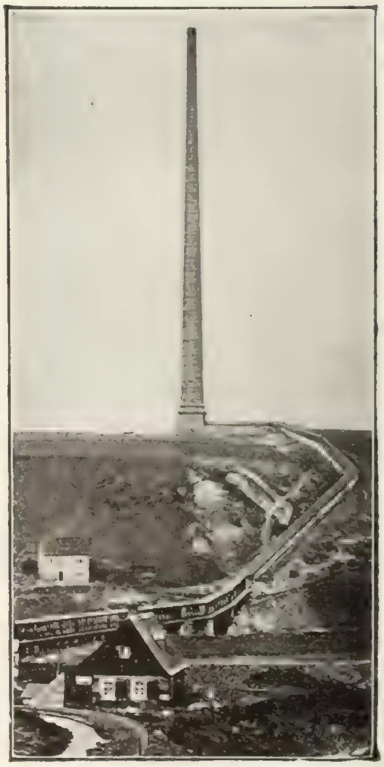
Write for analysis and samples

The

Asphalt & Supply Company, Limited

Sole Canadian Agents for the Mexican Eagle Oil Co.
Also Agents for MASTIC ASPHALT for Sidewalks.

428 Transportation Bldg., MONTREAL



460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

Write for catalogue

H. R. HEINICKE, INC. New York, U. S. A.

Representatives for Canada:
Black Building Supply Co,, Ltd. Toronto
Dartnell Ltd., Montreal Que.

Lay 200 More Bricks Every Day —

Hundreds of contractors to-day are laying 200 bricks more every day than they used to because they use

Renfrew Lime

in their mortar. It makes the mortar much easier to handle and it goes farther.

You can save 75 cents a day on every bricklayer by using our lime in your mortar.

Try "Renfrew" on your next job.

White Lime
Grain Lime
Drain Tile
Brick, Stone

Jamieson
Lime Co.
Renfrew, Ont.

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OUR EXPERIENCE — OUR STOCK — OUR MILLS
AT YOUR SERVICE

Heavy Yellow Pine and Fir Timbers up to 80 ft. on hand

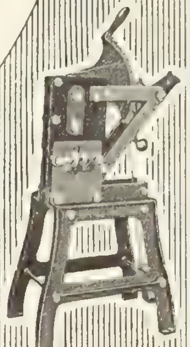
James Sheppard & Son

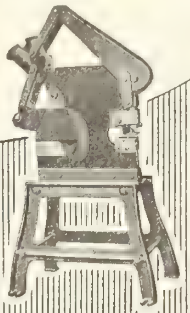
Sorel, Quebec

"Buffalo" Punches Shears and Drills

Among our recent designs is the Bar Cutter No. 10 for cutting concrete reinforced bars—twisted, round or any other shape. It cuts bars up to 1½" thick and, due to its steel frame, its **weight is only half** that of a cast iron machine of the same capacity. Ask for catalog of Steel Punches, Shears and Drills No. 145.

Canadian Buffalo Forge Co.
MONTREAL Limited
St. John Winnipeg
Toronto Vancouver





"Hammer Brand"

Hard Wall Plaster

HARD-WALL PLASTER HAMMER BRAND HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

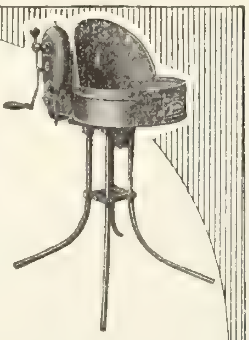
Albert Manufacturing Co.
Hillsborough, New Brunswick, Canada

"Buffalo" Forges

"Built to Last"

is the slogan of our **1912 Rivet Forge.** The repair cost by this design is guaranteed to be actually **cut in two,** compared with any other forge now in the market. A bridge company using a large number of forges writes us regarding it: "The operator claims it runs easier and heats more rivets in less time than any forge he has ever used." Let us send you one on free trial. Fifty other styles, for light and heavy work.

Canadian Buffalo Forge Co.
Limited
Montreal
St. John Winnipeg
Toronto Vancouve



THE Underwood embodies in one machine all that can be expected in a typewriter. It is sold at the price which should be paid for a machine of its quality.

United Typewriter Co., Ltd.
All Canadian Cities

MACK

Think of a Truck Saving $43 a Day Over Horses!

The City of Rutland, Vermont, owns a seven-ton Mack Dumping Truck, of which Mayor Clement writes as follows:—

"We moved on an average of 114 tons a day with this truck at a daily cost of $5. If this same work were done by teams it would require at least 12 teams costing, in this city, $4 each."

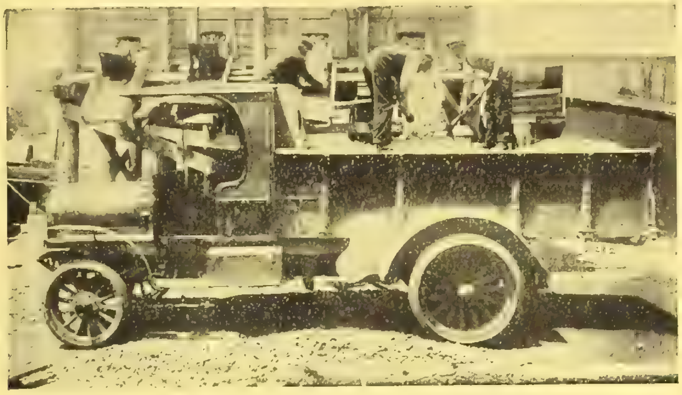
As it cost them only $5 a day to operate the Mack Truck this makes a saving of $43 a day over horses, and yet this is nothing extraordinary.

We have records of hundreds of Mack Trucks earning from $30 to $50 per day. Those who are not getting this result have not adjusted their business conditions to fit the motor truck unit.

An investment in motor trucks can be utilized twenty hours per day if desired, can double up in rush seasons, and does not deteriorate or wear out when idle.

The opportunities for utilizing the motor truck in contracting work are many and varied.

Would you like to know what motor trucks have done for other engineers and contractors? We have the data for you.



A seven-ton Mack Truck doing the work of eight mule teams in the constructiou of macadam road.

The Canadian Fairbanks-Morse Co., Limited

St. John, N.B. Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver

10

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Fifth of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

C. P. R. Hotel, Calgary

This building was wired with "Adanac" Rubber Insulated Wire

Architects and Engineers: E. & W. S. Maxwell, Montreal
Electrical Contractors: Parker-Chase Electrical Construction Company, Calgary.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd. Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"

Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

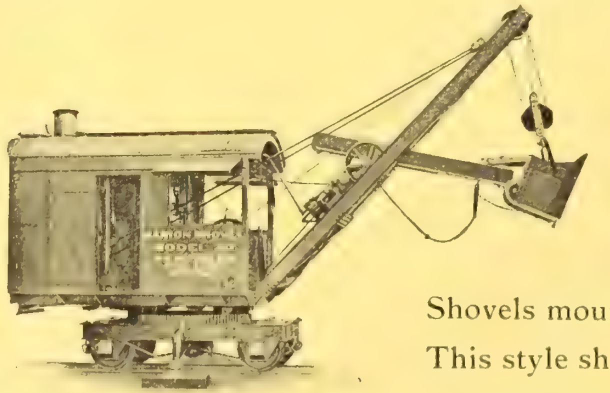
Brickyards, Quarries, Mines, Contractors, etc.

All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
5 8 - 1 and 1 1 2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

BRANCH OFFICES: General Supply Company of Canada, Ltd., Winnipeg Agents
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Vol. 27 Toronto, November 19, 1913 No. 47

ESTABLISHED 1886

Contract Record and Engineering Review

A Special

PUMP

For Your
Special Needs

The above is obtained by
placing the matter
with

The
**Smart-Turner
Machine Co.,**
Limited,
HAMILTON, ONT.

"MADE IN CANADA"

Bent Glass

Made in all
Kinds of
Glass
on Short
Notice

Large Bent Plate Glass for Shop
Fronts a Specialty

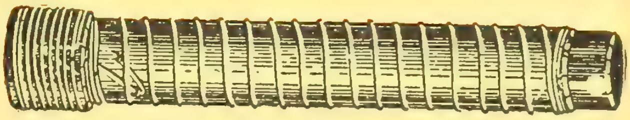
**The Toronto Plate Glass Importing
Company, Limited**
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works : 91 to 133 Don Roadway
TORONTO

Air Compressors
OF BELLISS MAKE
have gained their reputation for

- Simplicity of Design
- Noiseless Running
- Compact Design
- Low Oil Consumption
- Continuous Operation
- Overall Efficiency

Messrs. Belliss & Morcom, Ltd.
BIRMINGHAM, ENGLAND

Agents
Laurie & Lamb
Board of Trade Building, MONTREAL



Continuous and Machine Banded Wood Stave

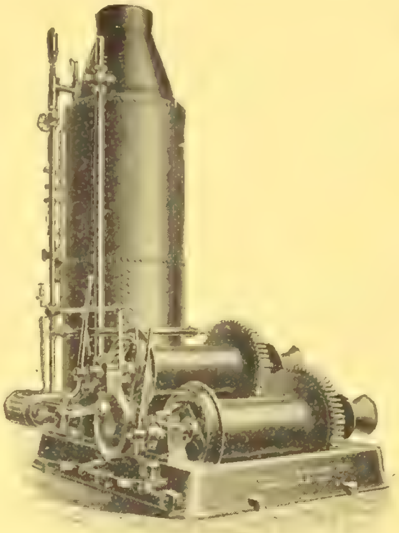
WATER PIPE

RESERVOIR TANKS

for city and town Water Systems,
Fire Protection, Power Plants,
Hydraulic Mining, Irrigation, etc.
One-half the cost of Iron Pipe—
and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

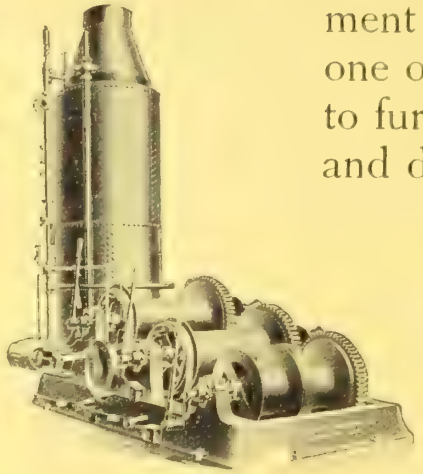
Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6



Hoisting Engines

With Single or Multiple Drums

¶ We build a wide range of these engines to meet every requirement of contracting work. Any one of our offices will be glad to furnish full particulars, prices and deliveries.

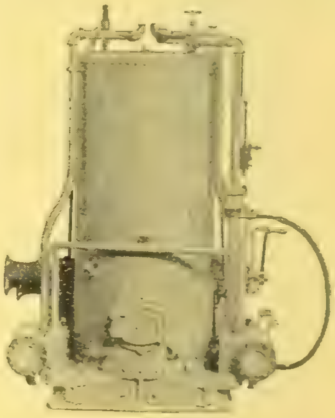


Each machine represents highest possible grade of material and workmanship.

The Jenckes Machine
Company, Limited

General Office—Sherbrooke, Que.
Works:—Sherbrooke, Que., St. Catherines, Ont.
Offices:—Sherbrooke, Montreal, Toronto, St. Catherines, Cobalt, South Porcupine, Nelson, Vancouver.

LESS FUEL—
MORE POWER



"AMERICAN" Boilers contain from twenty to thirty per cent more flues than any other boiler built

More heating area means more steam—more steam means more power.

The new "AMERICAN" direct exhaust from each cylinder gets the greatest possible power out of this increased steam supply.

Jobs are finished in less time, pay roll and other expenses shrink and profits and prestige grow.

One of the biggest contractors in the country has—92—"AMERICAN" Engines. That's one of the reasons he ranks among the biggest. Made by

AMERICAN HOIST & DERRICK COMPANY
ST. PAUL, MINN., U. S. A.

SOLD BY:
General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada. Stuart Machinery Co., Winnipeg, Man
Vancouver Machinery Depot, Ltd., Vancouver, B. C. Gorman, Clancey & Grindley,
Edmonton and Calgary, Alta., and Nelson, B. C.

CANADA Portland CEMENT

SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

PORTLAND
CANADA
CEMENT

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

Canada Cement Company, Limited

Head Office - Montreal

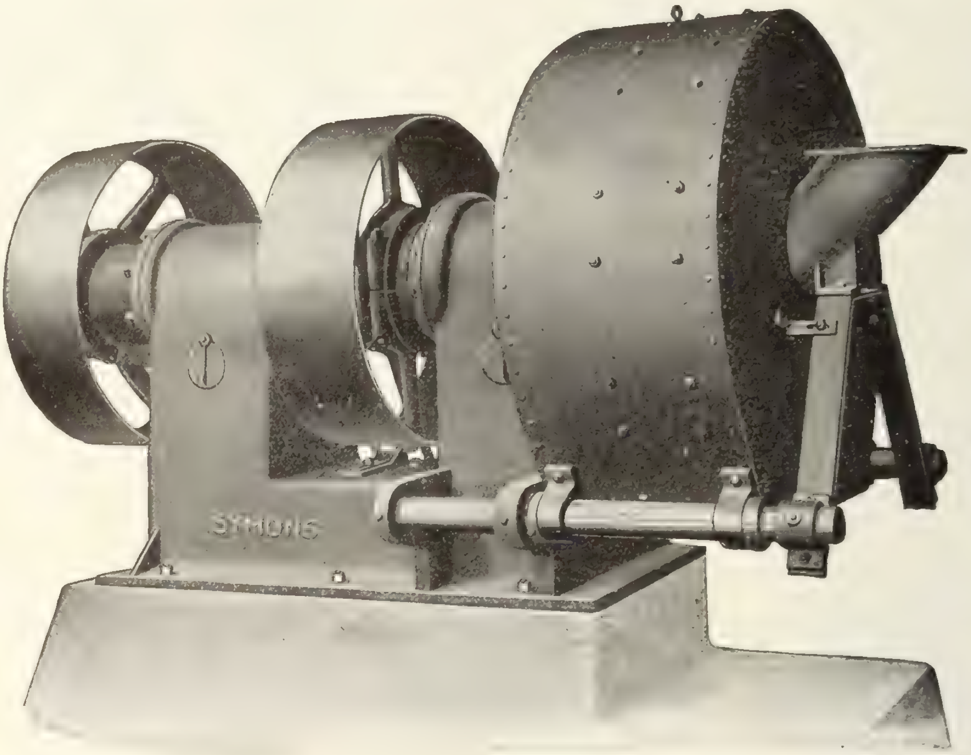
Sales offices at

Montreal - Toronto - Calgary - Winnipeg

The Greatest Recrusher

The

Symons Disc Crusher



It is the only Crusher, which will take the rejections, screened or unscreened, from standard gyratory crushers and reduce same rapidly at one operation to 3/4 inch size and less.

Will crush 40 tons of ¼ inch to 1,000 tons of 2½ inch stone per ten hour day.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 365 Water Street

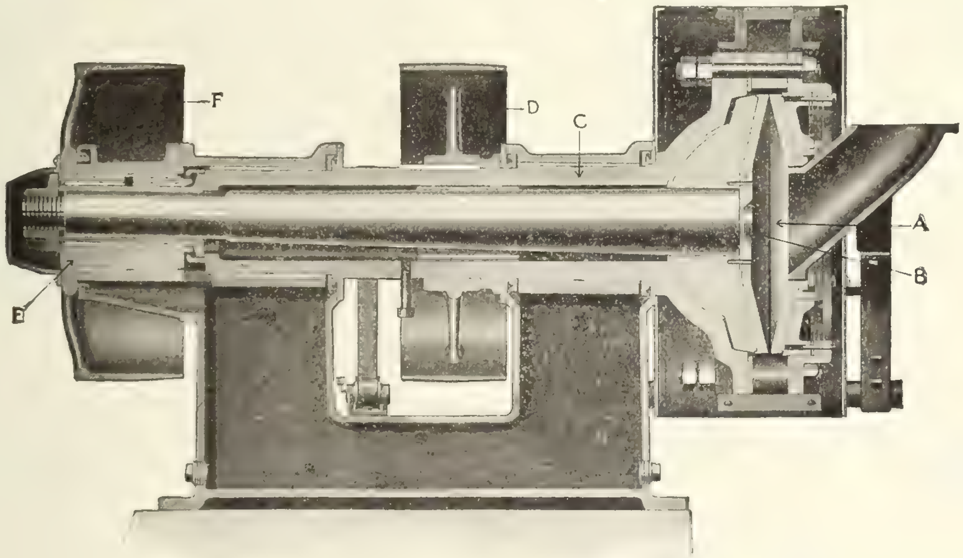
QUEBEC, 31 St. Louis St.
ST. JOHN, N. B., 57 Smythe St.
HALIFAX, 78 Granville St.

A Contractor Writes:

The

Symons Disc Crusher

"is efficient in operation, economical in repairs and perfectly satisfactory in every respect."



It gives the greatest amount of service at the least initial cost and expense of maintenance.

Send for Catalogue

Mussens Limited

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VANCOUVER, 365 Water Street

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- Drill Steel Sharpeners
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- Hoisting Apparatus
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  - Canadian Fairbanks-Morse Co.
  - Wettlaufer Bros.
- Hydrants
  - Canada Iron Corporation
  - Gartshore-Thomson Pipe Co.
  - Kerr Engine Company

(Continued on page 12)

The New
Royal Bank
Building,
Toronto,
To be
Fireproofed
Throughout
With
Don Valley
Porous
Terra Cotta
Fireproofing

The Largest Contract For Porous Terra Cotta Fireproofing

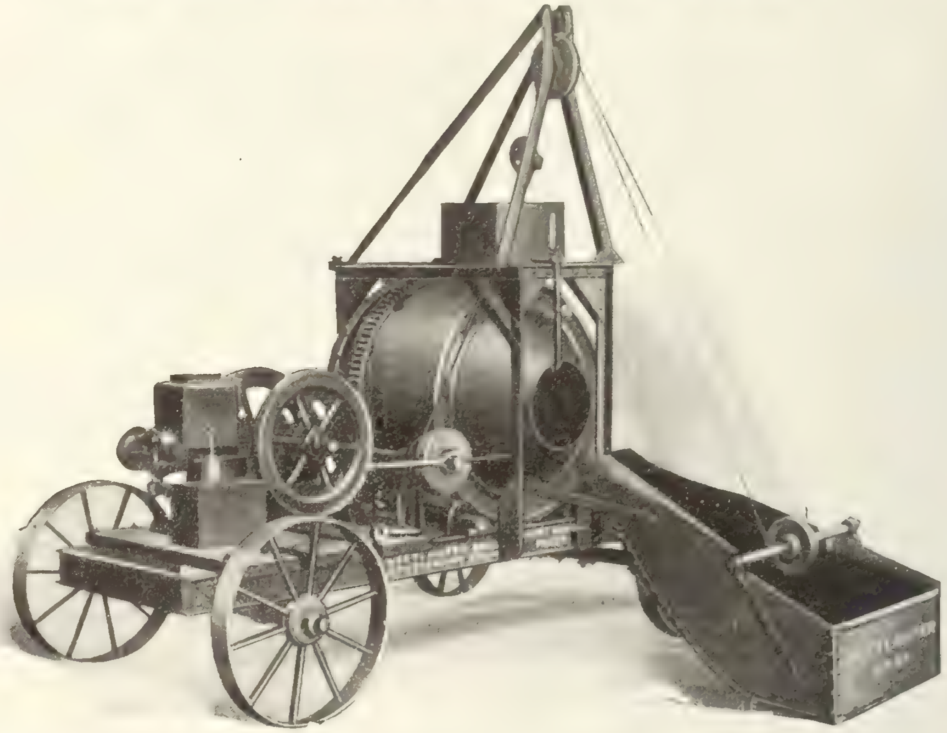
The largest contract ever placed for one building in the British Empire has been made for

Don Valley Porous Terra Cotta Fireproofing

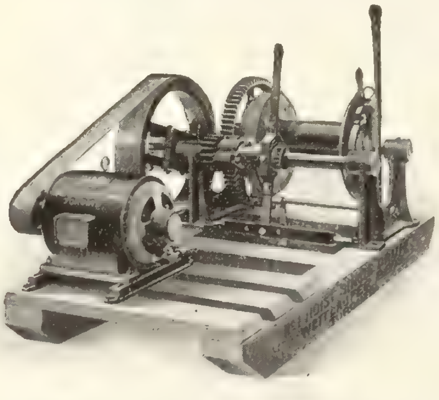
to be used in fireproofing the Royal Bank Building, Toronto.

Don Valley Brick Works,
Limited,
Toronto, Ont.

One of the Newest in the Wettlaufer Line

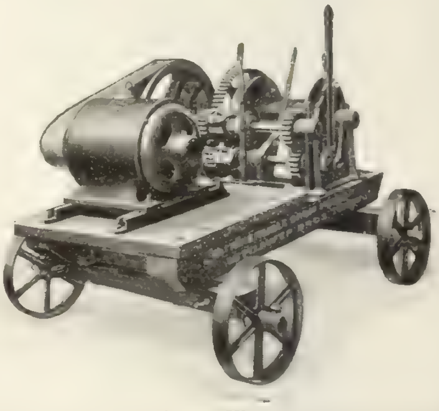


The Wettlaufer Heart Shape Stationary DRUM MIXER with Automatic lift makes it possible for the contractor to increase his capacity without increasing his labor. One demonstration will convince you of its merits.



Single drum motor driven Wettlaufer Hoist

TWO VERY EFFICIENT HOISTS



Reversible single drum motor driven Wettlaufer Hoist on trucks

The Wettlaufer Line of Heartshape Mixers is the Most Complete in Canada

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L. Lachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagauchetiere St. W., Montreal.

Rogers' Portland Cement

AND CRUSHED STONE

The most dependable for all types of construction and engineering-contracting work — especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, &c.

Rogers' Brands:

PYRAMID DORIC SUPERIOR
STERLING SAUGEEN

Mills at:

KIRKFIELD ST. MARY'S HANOVER
ORANGEVILLE OWEN SOUND

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

Concrete Tank at Berlin, Ont.
BUILT WITH ROGERS' CEMENT.
L. J. MENSCH, M. Am. Soc. C.E., CHICAGO, ILL.
Engineer and General Contractor.

Crushed Stone

Our crushed stone is free from dust, dirt and mold—it is really clean stone—properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

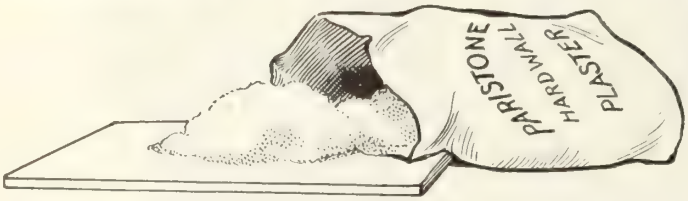
Paristone Hardwall Plaster

Owner is Satisfied

Makes good friends

Builder is Satisfied

Because it has the reputation of good setting qualities and makes the strongest wall



Sold where You see this Trade Mark →

THE ALABASTINE CO. LIMITED
OFFICE-PARIS ONT. MILLS CALEDONIA ONT.
PLASTER PRODUCTS

Grey gypsum makes the best plaster. We own the only mine of this rock in Canada, hence the superiority of "Paristone."

THE ALABASTINE CO., LIMITED PARIS, ONTARIO

ORPEN CONDUIT MANUFACTURING Co. of CANADA
MANUFACTURERS OF XCELADUCT AND ORPENITE CONDUITS
TORONTO HEAD OFFICE ONTARIO

The Sign of Good Conduit

"Xceladuct" and "Orpenite" Conduit

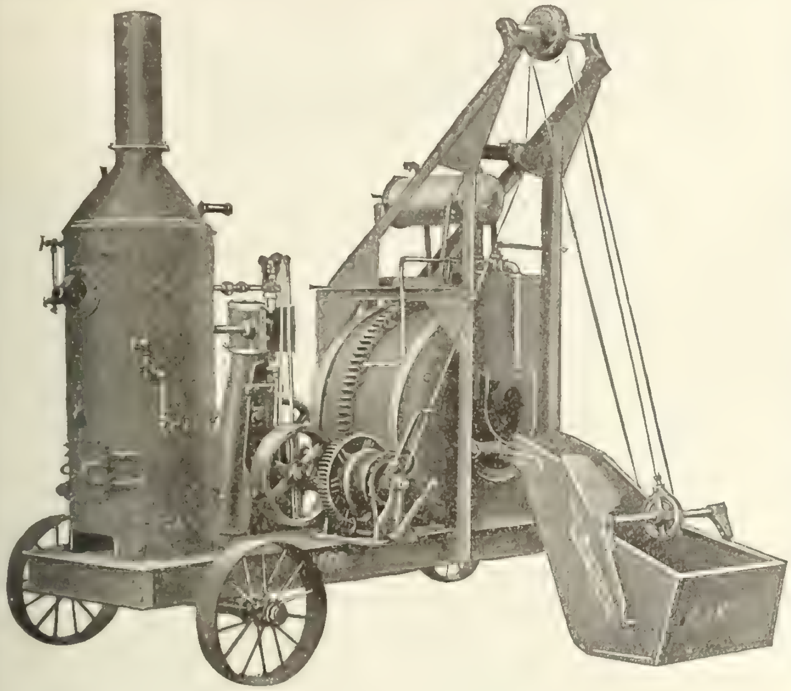
"Xceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

"Orpenite" Enameled Conduit—Easy Bending Spellarized Steel Tube; protected against rust by coatings of special enamel not affected by temperature conditions, smooth interior.

We solicit an opportunity to submit prices and other particulars.

Orpen Conduit Manufacturing Co. of Canada
TORONTO, CANADA **Montreal, Quebec**

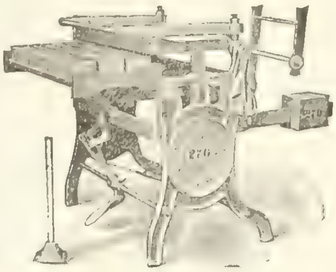
HAVE YOU SEEN OUR 180 PAGE CATALOGUE?



London Standard Drum Batch Mixer

Showing the largest line of Concrete Machinery ever crammed into a Catalogue.

All made in our own Factory and under a system producing an excellence of quality. Our large output right from Factory to the Contractor.



London Cement Brick Machine.

Even such remarkably low prices are preferable to exorbitant prices and small output.

Some people wonder how we can sell high grade machinery at such low prices. **It is quite simple. Our Enormous Sales and Small Profits are sufficient explanation.**

We manufacture over twenty different sizes and styles of **Concrete Mixers, Mortar Mixers, Concrete Block Machines, Cement Brick Machines, Cement Tile Machines, Tile Moulds, Rock Crushers, Screens and Elevators.**

London Cement Block Machine.

Gasoline Engines

Pumping Outfits

Steam and Gasoline Hoists

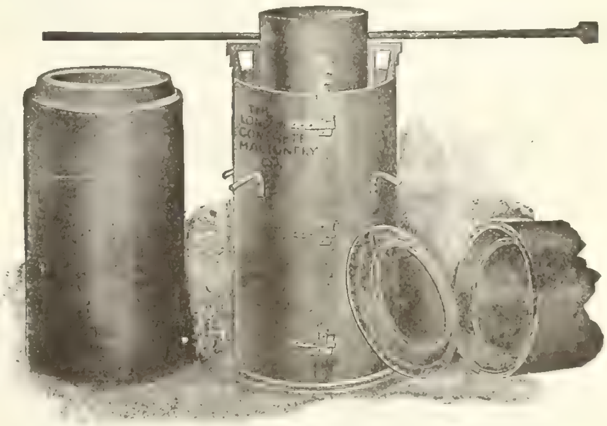
Material Elevators

Sidewalk Forms

Sidewalk Tile Machines

Concrete Carts

Wheel Barrows



London Sewer Pipe and Tile Moulds.

Sill, Step and Widow-Cap Moulds

A Complete Line of Cement Working Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:

WINNIPEG (445 Main St.) W. H. Rosevear, Mgr. CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (60 Richmond St.E.) F. D. Emsley, Mgr.

AGENCIES:

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FORT WILLIAM, Northern Eng. & Supply Co. MONTREAL, Foss & Hill Mach. Co. QUEBEC, A. D. Masson

We are the Largest Manufacturers of Concrete Machinery in Canada.

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  - Linde British Refrigeration Co.
- Insulating Compounds
  - Standard Underground Cable Co. of Canada, Limited
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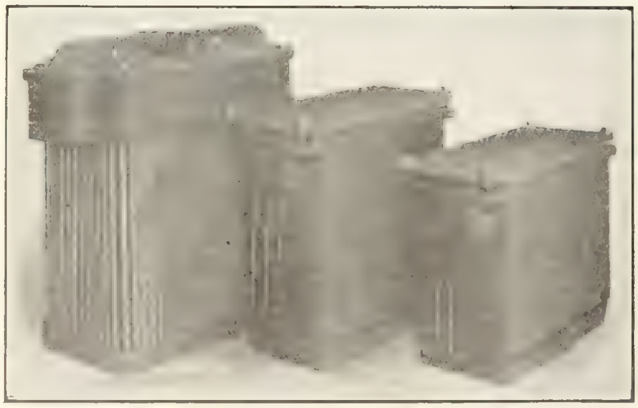
Power Logic

Reduced Loss
Increased Profit — **Ferranti Transformers**



Three Phase Pole or Station Transformers

The Transmission line that is equipped with Ferranti three phase transformers is always a profitable one because of the great reduction in energy-loss made possible by these efficient transformers.
All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

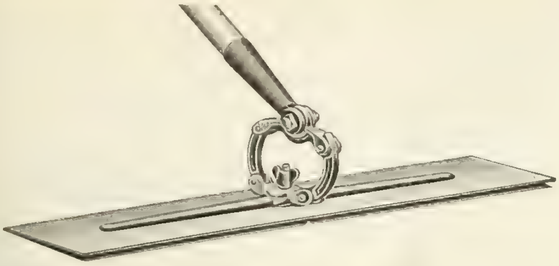
Three phase transformers are the most economical type to operate and will effect a considerable saving in construction cost.

Write us for particulars

The Ferranti Electrical Co., of Canada, Limited

TORONTO
90 Sherbourne St.

WINNIPEG
56 Albert St.



TIME IS MONEY

SAVE TIME AND YOU SAVE MONEY

The greatest time savers on the market are the **"Abram"** Cement Tools. They are in use in all the principal cities of Canada and the United States.

We guarantee that one man can do more with "Abram" Tools than three men with ordinary sidewalk Finishing tools, or in other words that you can save the wages of two men by using our patent tools.

The Abram products will increase the area of finished cement per day, will produce a better quality of work with more speed and less labor and eliminate all necessity of your workmen kneeling down to the job.

Our booklet is yours for the asking.

Abram Cement Tool Co.
105 Ouellette Ave. Windsor, Ont.

The Most Complete and Up-to-date Line of Earth and Stone Handling Machinery in the Continent of America.

DUMP CARS—SCRAPERS—
ELEVATING GRADERS—
DUMP WAGONS—

Write for Catalogue

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery

Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta.
Can. Equipment Co., Montreal—Agents for EasternCanada.

Hagersville Crushed Stone

The Toughest Stone for Macadam in Ontario

Record of Logan Avenue, Toronto, Macadamized from Queen St. to Gerrard St., in 1902

Length 2,454 Lin. Ft. Width 24 Lin. Ft. 6,550 Sq. Yds.

COST FOR REPAIRS	1903	$ 0.00	1908	$ 93.26
	1904	3.30	1909	200.46
	1905	9.35	1910	14.07
	1906	37.33	1911	2.29
	1907	16.11		

Total $376.17 or 5⅔c. per sq. yd. for repairs for nine years, a little over 6-10 of 1c. per sq. yd. per year.

Why Not Use Hagersville Stone and Get These Results?

Hagersville Contracting Co.
Hagersville, Ont. Limited

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- Taylor, J. & J.

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- Canada Iron Corporation
- Dominion Sewer Pipe Co.
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- National Iron Works
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- Can. Billings & Spencer
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- Lecky & Collis

Steel Bars
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- Steel Co. of Canada
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- Gerald Lomer, Limited

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- Brodie, James
- Consolidated Stone Company
- Contractors' Supply Company
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- Dominion Bridge Company
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- Mackinnon Holmes & Co.
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- Hamilton Mfg. Co., Wm.
- Inglis, John
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- Piggott & Co., Thos.
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- Sheldons Limited
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Vacuum Cleaners
- Tuec Company
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- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company
- Pittsburgh Valve, Foundry & Construction Company

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- Standard Underground Cable Co. of Canada, Ltd.

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- Cabot Inc., Samuel
- Can. H. W. Johns-Manville Co.
- Ceresit Waterproofing Co.
- Wadsworth Howland Co.

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- American Water Softener Co.

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- Mueller Mfg. Co., H.

Water Turbines
- Canadian Allis-Chalmers, Ltd.
- Boving Company of Canada
- Escher Wyss & Co.
- Hamilton Mfg. Co., Wm.
- McDougall Caledonian Iron Wks.

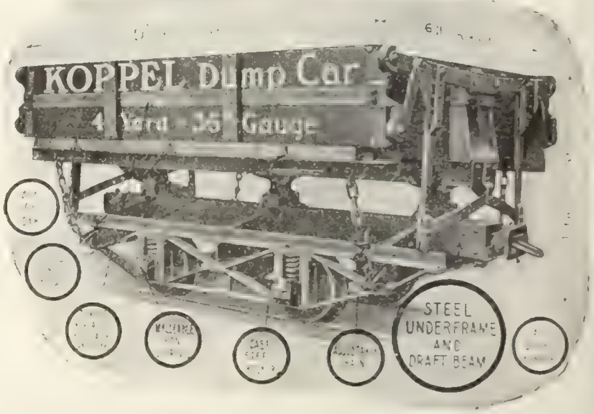
Wires and Cables
- Canada Wire & Cable Co.
- Imperial Wire & Cable Co.
- Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
- Canada Wire & Iron Goods Co.
- Greening Wire Co., B.
- Steel Company of Canada

Wire Rope
- Canada Wire & Cable Co.
- Greening Wire Co., B.
- Steel Company of Canada

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Barrett Specification Roofs

If you should specify merely "a five ply tar-and-gravel roof" instead of a "Barrett Specification Roof"—

You *might* get as good a roof as a Barrett Specification Roof though built somewhat differently—

But on the other hand, you may get materials of uncertain qualities,—

Or a roof with little or no pitch between the layers,—

Or a scanty surface coating of pitch and gravel—

And you wouldn't know about it until a few years later—*when the roof leaked*—

But if you put the Barrett Specification into your building specifications and see that it is carried out, you are sure—

1. That the materials will be right.
2. That they will be used in the right amount and in the right way.
3. That your roof will last upwards of twenty years without another cent of expenditure.
4. And that the cost per foot per year of service will be lower than it could possibly be with any other kind of roofing.

As Barrett Specification Roofs cost less than any other permanent roof to begin with and as their maintenance cost is nothing, the unit cost comes down to about ¼c. per square foot per year, a figure unapproached by any other roof covering.

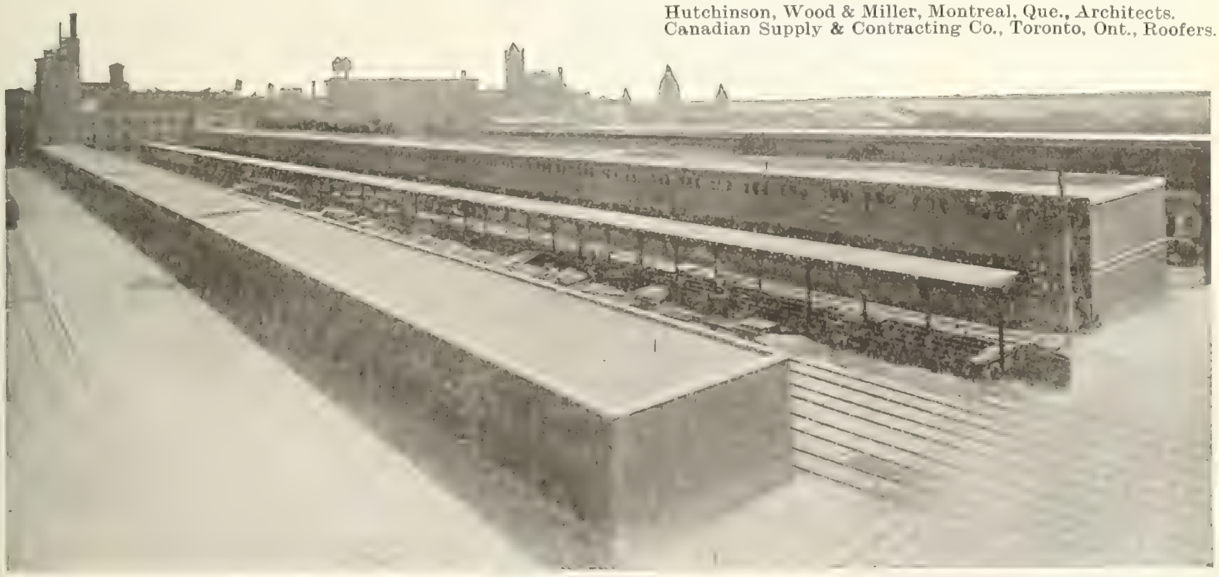
Copy of the Barrett Specification with tracing ready for incorporation into your building plans, sent free on request. Address nearest office.

Special Note We advise incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested. ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

THE PATERSON MFG. CO., Limited

Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

Hutchinson, Wood & Miller, Montreal, Que., Architects.
Canadian Supply & Contracting Co., Toronto, Ont., Roofers.



Canadian Pacific Railway Co.'s Freight Sheds, Toronto, Ont.

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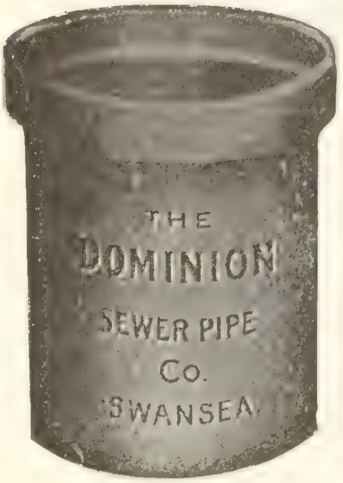

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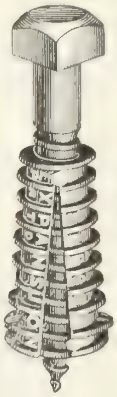

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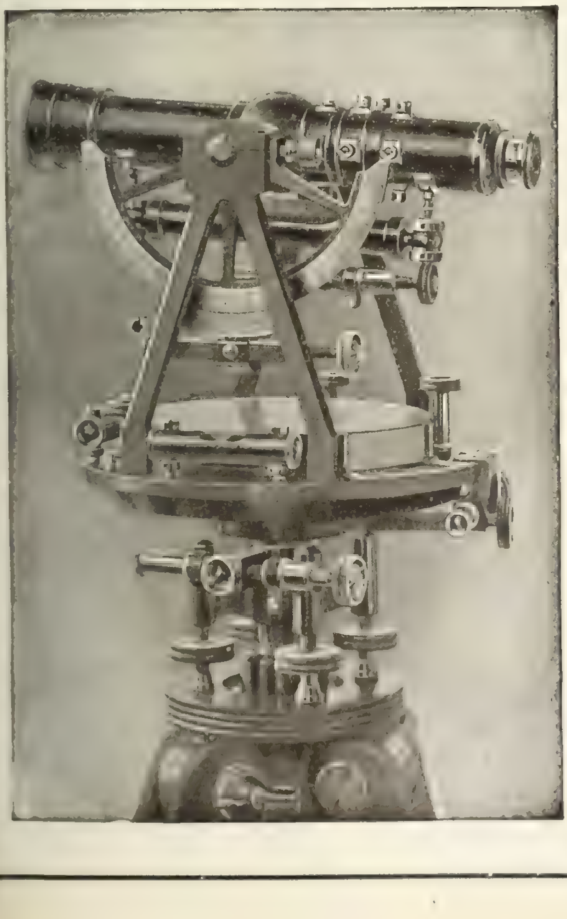

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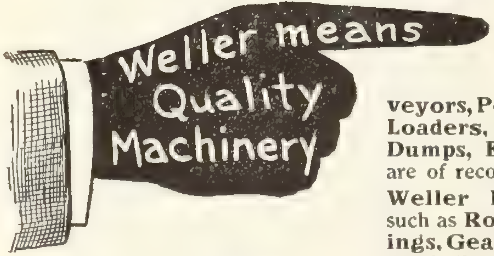

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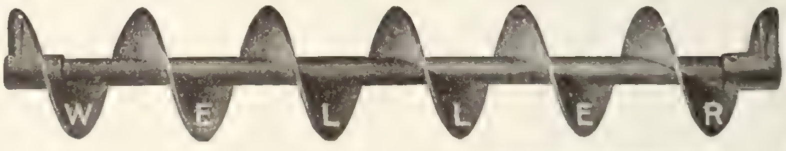

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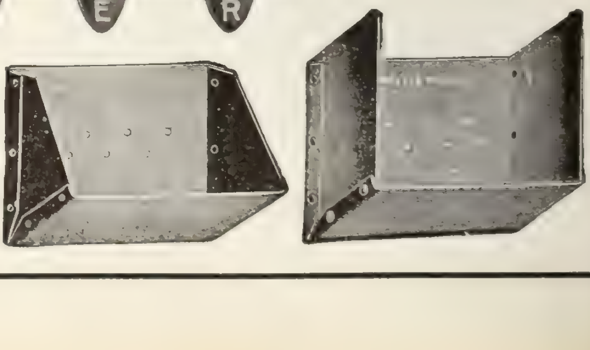

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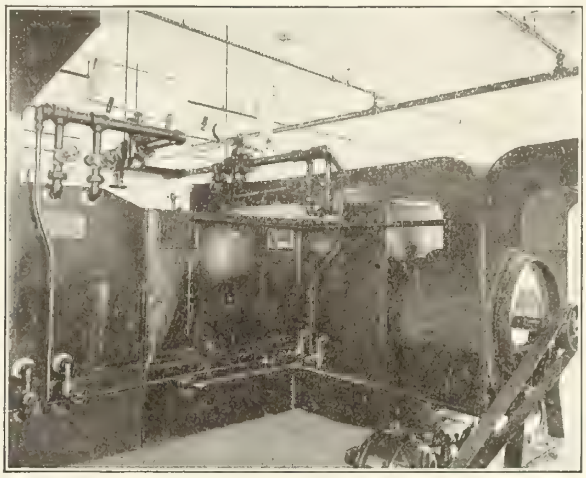

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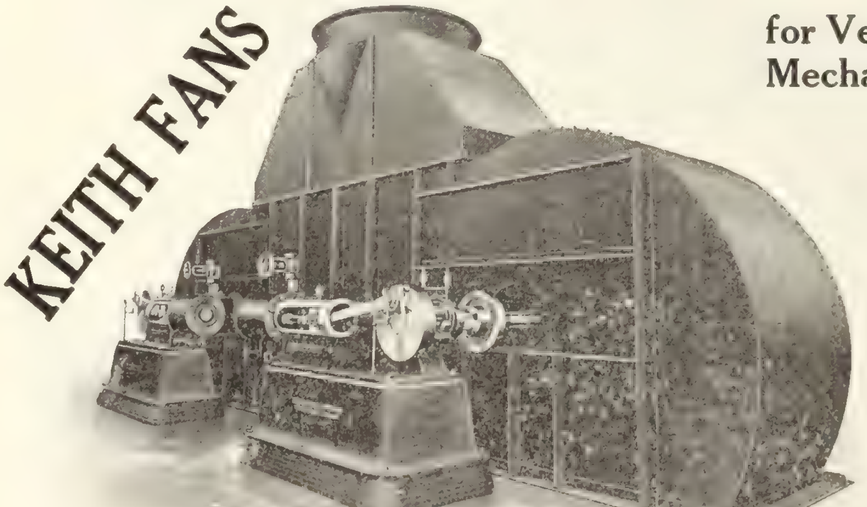

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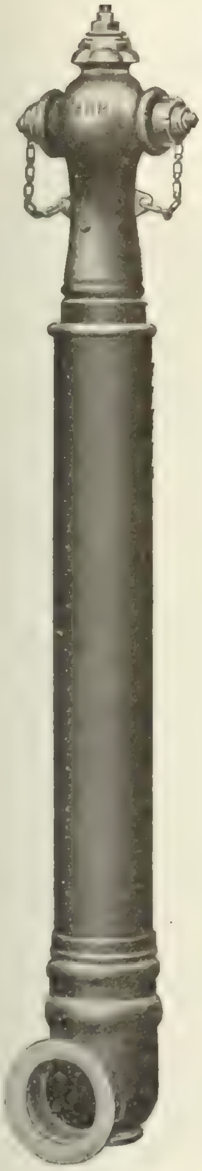

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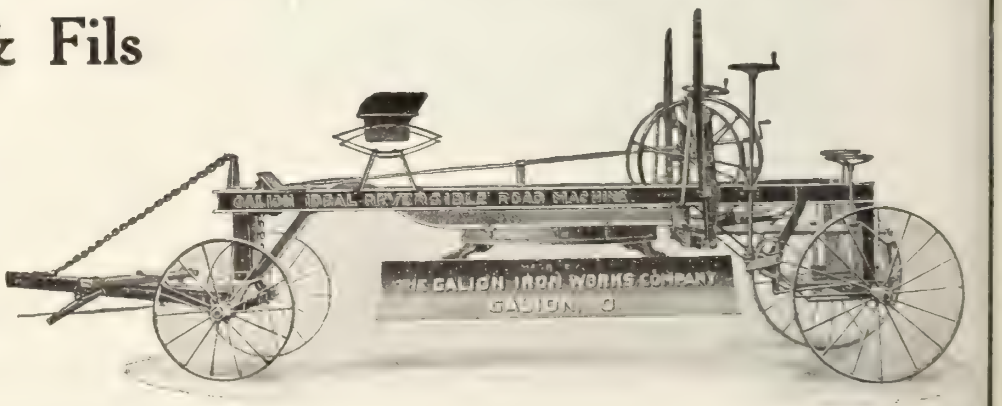
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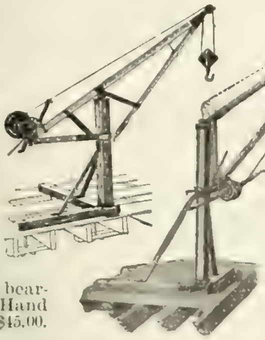

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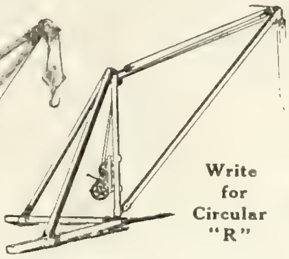

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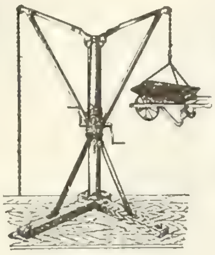

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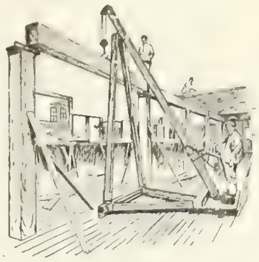

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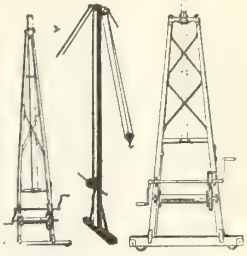

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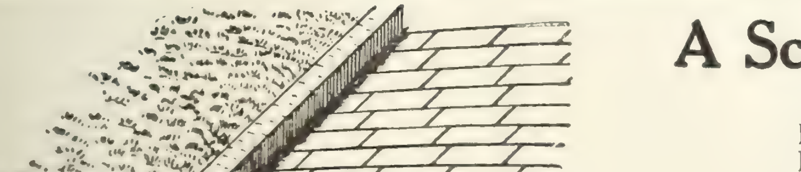

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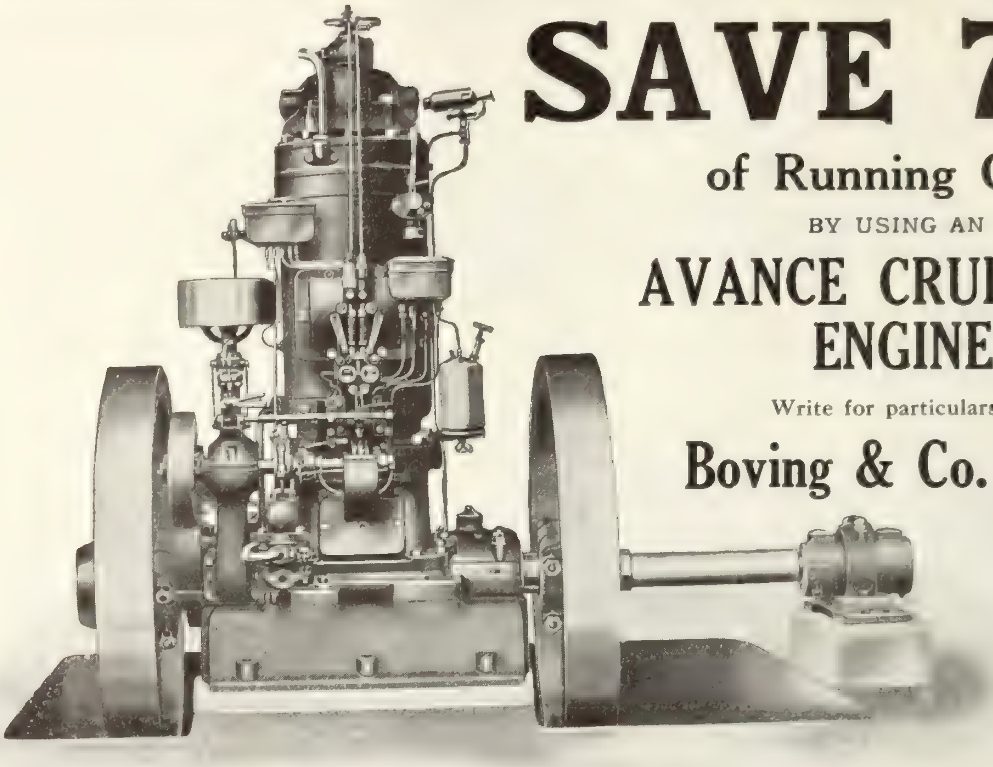

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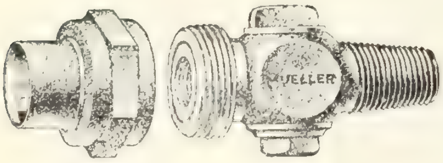

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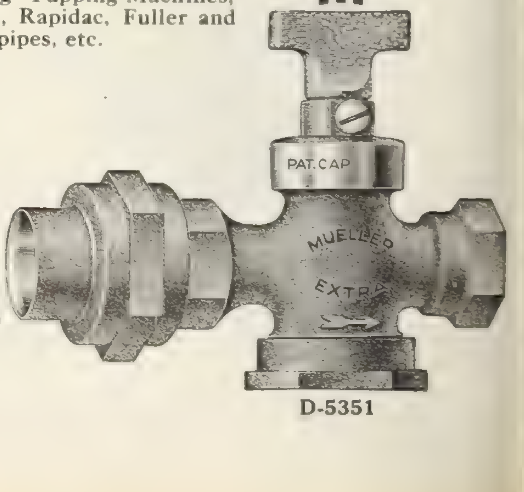

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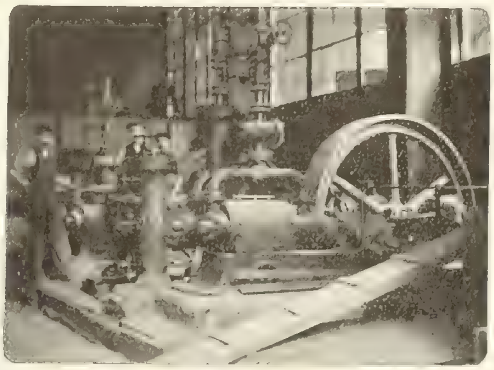

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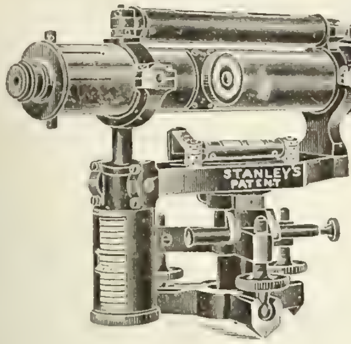

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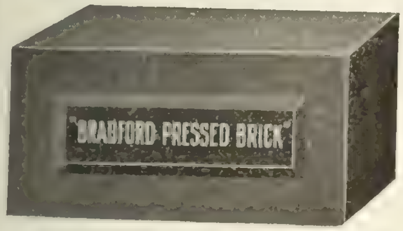

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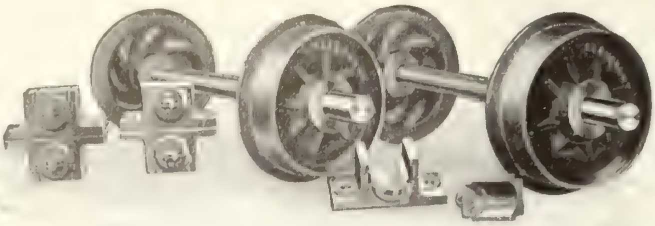

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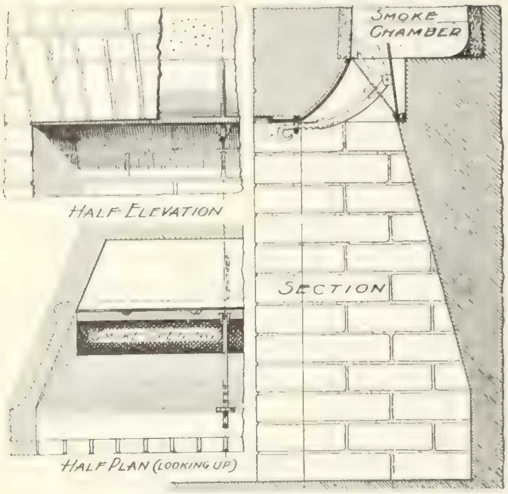

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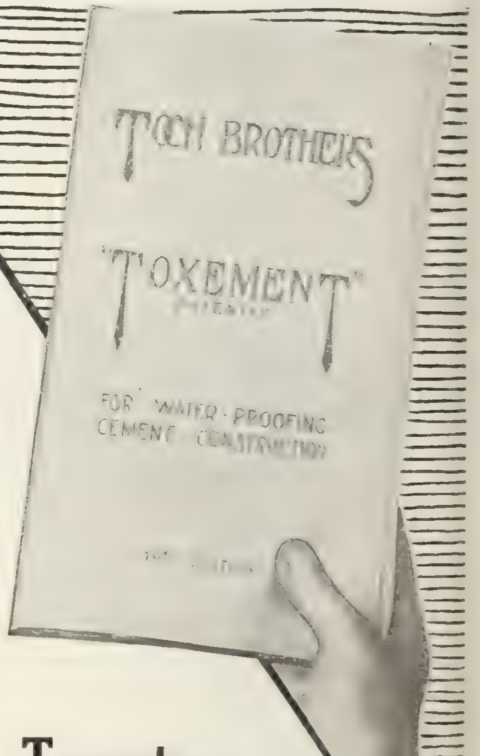

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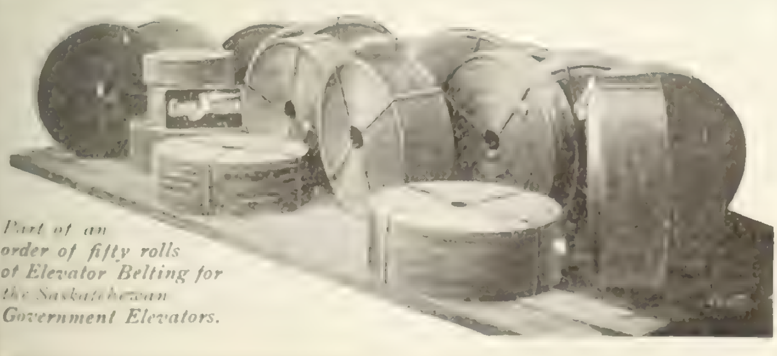

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Vol. 27 **November 19, 1913** **No. 47**

The Gratuitous Bid and the Quantity System

THE editorial articles, "The Gratuitous Bid" and "Competitive Tendering," published in our last issue, have elicited from Mr. H. Bryan Gilbert, of London, Ont., a letter (published elsewhere in this issue) which constitutes a strong plea for the adoption of the Quantity System. The keynote of Mr. Gilbert's remarks is that neither the contractor nor the owner profits by the under-estimated bid; that if a number of men go to the trouble of pricing a bill of quantities and one of them, perhaps by virtue of an omission, comes out easily the lowest and obtains the job, the workmanship and material will suffer, whereas with uniform data distributed to the tenderers the successful tenderer is likely to be the closest figurer and the most able contractor.

Discussion of quantity surveying comes up perennially, but in view of the fact that the system has strong claims and that it appears to be growing in favor Mr. Gilbert's letter can hardly be passed unnoticed. As showing the trend of events on the other side of the border, it is interesting to note that an American Institute of Quantity Surveyors has just been organized at San Francisco and that local councils are being established in various cities throughout the United States with a view of impressing engineers, architects and contractors with the merits of the system.

Additional proof of the increasing consideration which quantity surveying is receiving in the United States is furnished by the attention which it is receiving editorially from recognized authorities in the field of technical journalism. We are reminded by the "Engineering News" that in Great Britain, "bills of quantity" always accompany the advertisement of bids for the erection of a building or the construction of any large work. Such a bill is furnished by the owner, architect, or engineer to the prospective contractor and professes to be a correct list of the quantities of work to be done and material to be provided. The contractor makes his bid, either with unit prices or as a lump sum, from this bill as a basis of quantity and with his own estimate of prices. In case he adopts the unit-price method any extras are, of course, taken care of automatically. If a lump-sum bid is made, the "bill of quantity," unless specified to the contrary in the contract, is merely supposed to be an estimate similar in that respect to the limited estimate of quantities sometimes made by the designing engineer or architect in American practice, but differing in that the estimate is very complete, and is made by a disinterested but qualified person known as a "quantity surveyor," whose profession it is to make just such estimates. The estimates then become close approximations of the amount of work to be done and can safely be used by the contractor in making up his bid. Of course, as a precaution he may go over the plans and specifications for his own satisfaction, for the estimate made by the quantity surveyor is not guaranteed and does not bind the owner unless the contract is so drawn. It nevertheless has the weight of disinterested authority, since the reputation of the man making it and consequently his professional standing depend on the accuracy of his estimates. Lump-sum bids made upon it, however, stand or fall by the contract and specifications and are not governed by the estimates.

In this country the "quantity surveyor" is not known. When occasionally the architect or engineer does condescend to present a list of quantities he specifically warns the contractor that the quantities are of little use. As a result each bidder on work is forced to go to the expense of making a detailed estimate of the quantities involved in the contract and the cost of this general estimating is not only assessed on the owner, but is also distributed among the many bidders as an economic loss. Furthermore, it often happens that the successful bidder has made only the roughest kind of estimate of the amount and on finding his bid under the cost of work attempts any and all kinds of skinning on the work in order to come out even or ahead of the game.

While in the largest kinds of engineering construction it is probable that the system of quantity surveying would be of little value, because the bidders on large work will undoubtedly wish to make their own estimates, in smaller contracts and in building work particularly, where it is easy to estimate from plans and specifications the exact amount to be used, the quantity-surveying system is a very good one.

How Engineering Societies Can Educate the Public

THE possibilities for educational work by an engineering society, comments Engineering and Contracting, naturally divide into two essentially different forms, namely, the education of the individual members of the organization by association with the other members and by participating in, listening to or reading the technical proceedings of the society, and, secondly, the influence of the society as a body in moulding public opinion. The first function mentioned is well understood by many engineers at this time, but the opportunities for doing effective educational work of the second type mentioned, often of equal importance with the first, is very generally overlooked or neglected.

In this issue we publish a brief statement of the influence of the engineering society in educating its members. This statement is addressed primarily to young engineers, but it is equally applicable to the engineer of experience who has not become a member of an engineering society.

However, it is to the opportunities available to engineering societies for educating the public that we wish to call particular attention at this time. Anyone who reads the proceedings of our various societies year after year must be impressed by the fact that an unbridged gulf now exists between the educators and those whom they seek to educate. The foregoing statement does not relate to matters of interest to engineers only, such as the majority of the technical studies presented before the societies, but to the subjects from time to time discussed which are or ought to be of interest to the public. An example of the last mentioned type of subject will be given.

Within the past year or two practically every civil and municipal engineering society in the country has had presented before it and has published in its proceedings at least one paper calling attention to the neglect of sewage treatment plants by municipalities. This matter has been very clearly set forth in all of these papers. It has been well understood for several years by engineers. What good, then, has been accomplished by repeating the familiar story in the proceedings of technical societies. It is not likely that conditions have been bettered as yet as a result of the points brought out in the papers mentioned for the reason that the public does not know what the papers contained. The problem before the engineering society in educating the public through the medium of its proceedings is to bring those proceedings to the attention of the public. We believe that this can best be done through the medium of the daily newspapers.

Many of the best newspapers are now glad to publish matter of this kind. It is true that they do not seem to go very far in search of such matter, but it is equally true that they will give some space to it if it is sent to them in proper form for publication. The Cleveland Engineering Society and the Brooklyn Engineer's Club, and perhaps other similar organizations, now enjoy the co-operation of the daily papers in the public discussions of various questions upon which the members of the societies are especially well qualified to express opinions. The experience of the Cleveland society is of interest, and will be briefly stated.

In the fall of 1912 the society appointed a publicity committee. This committee prepared articles for the daily papers, written in popular style but dignified in tone and free from any suggestion of sensationalism. It soon became evident that the newspapers were glad to receive and publish such authoritative communications. The chairman of the committee concludes that both the public and the engineering profession would benefit from organized efforts, on the part of the engineering societies throughout the country, to get in touch with the public through the newspapers.

What has been done in Cleveland can be done in other cities by local engineering societies or clubs. If the big metropolitan dailies will make room for matter of this character it seems a certainty that the papers in the secondary cities and small towns will do the same, for the latter papers usually are less fortunate than the big dailies in the quantity of acceptable matter available for publication.

Obviously many people can be reached in a day through the newspapers who could not be reached in a lifetime through the ordinary form of publishing the proceedings of technical societies. The present form of publishing the full proceedings is essential to the first form of educational work within reach of the society, that within its own membership and among engineers generally, but it is almost useless as a popular educational agency. To reach the public surely and quickly the newspapers must be used.

Road Progress in Quebec

THE Quebec Government have decided to appoint a Minister of Roads, in order to allow the Minister of Agriculture, who is now responsible for the road department, to devote his attention to agriculture alone. In the Address from the Throne, read at the opening of the Quebec Legislature, it was stated that the impetus given by the Government to the improvement of the roads had produced results far exceeding expectations. Not only has satisfactory progress been made in the work on the great highways which it has undertaken but the municipalities have awakened to the importance of energetic initiative on their part, and many of them have availed themselves of the Good Roads Act.

The Hon. J. E. Caron, reporting on the same subject, states that of the $10,000,000 provided by the act of 1912, the municipalities have applied for $8,197,448, which is guaranteed by the Government, which pays half the interest and the municipalities the other half. Mr. Caron estimates that in five years there will have been constructed under this act 2,000 miles of macadamized roads in the province. A striking contrast is afforded by the statement that in 1894-5 but $75 was spent by the Government for the improvement of roads, while in 1913 from July to October 15, the Government disbursed on good roads the sum of $1,592,392.

Up to October 15, 1913, 376 municipalities applied for aid under the act of 1912, of which number 166 complied with all conditions and were granted funds, the others are negotiating. In 1913 400 rural municipalities placed their roads in charge of municipal corporations, and according to estimates made about 15,000 miles of roads are now under this system of maintenance. In 1913, under the law of 1911 and 1912, there were 225 miles of macadamized roads made and 60 miles of gravel roads. Since 1908, 189 iron bridges have been built, and 40 new ones are in course of construction.

The Canadian Steel Industry

IT would almost appear that, if the present rate of progress in steel manufacture continues, Canada will be able soon, not only to supply her own wants as regards steel, but also be able to enter the markets of the world. Prior to 1902, Canada made very little steel. The output advanced from 26,084 gross tons in 1901 to 182,037 gross tons in 1902. Five years later, in 1907, it had reached 646,754 tons, and five years later still, in 1912, it increased to 853,031 tons, the largest output in its history. It is quite probable that in the present year Canada will make nearly 1,000,000 tons of steel, or more than the United States made in 1879. The steel output of Canada is largely in the form of ingots, over 96 per cent. of the total in 1912 being in this form, and less than 4 per cent. in the form of direct castings. The two largest centres for steel in the Dominion are Ontario and Nova Scotia. In 1909 Nova Scotia led Ontario by 28,201 tons, in 1910 by 11,943, and in 1911 by 20,623 tons. In 1912, however, Ontario forged ahead by 1,321 tons. Nova Scotia has within its borders the new and modern plant of the Dominion Steel Corporation, while Ontario has within its boundaries the large and modern plant of the Algoma Steel Corporation. Naturally, the output of finished rolled forms of iron and steel in Canada increased in the same ratio as steel ingots and castings. In 1902 the total rolled output was 161,485 tons. In 1907 it had increased to 600,179 tons, and in 1912 to 861,224 tons, the maximum. Much the larger part of the total was steel—about 87.5 per cent. in 1912. Rails formed almost one-half of the total rolled output of the Dominion in 1912—over 49.2 per cent. It was not till 1902 that Canada began to manufacture steel rails on a large scale. In that year it made 33,950 tons. Its output in previous years had seldom exceeded 800 or 900 tons. In 1912 the rail output reached 423,885 tons, its best yearly record.—"Engineering," London.

Scientific Principles of Estimating

By F. Tissington[*]

A GREAT deal of paper and ink have been used up on this subject, and therefore the probabilities of the writer being able to state any new facts are correspondingly small. However it was thought that the practical experience derived from some twelve or fourteen years' work might be of some help to the younger members of the engineering profession.

Most of the subject matter relates entirely to the structural steelwork line, but the general principles involved can be readily applied to practically any branch of engineering work.

In the first place the ultimate goal to try for is the acquisition of orders, and, secondly, that they are obtained without the expenditure of more money than is absolutely necessary.

Generally speaking it is a difficult matter to induce a buyer to part with more cash than the lowest bidder asks for a particular service. Occasionally you will come across the man who will pay a higher price where he thinks he will get a corresponding advantage, but this only happens as a rule with special work or machines and will not apply to anything in the nature of a standard article.

The whole question therefore resolves itself into one of price, and providing this is right there is very little necessity to keep up a big outside staff.

In a general sense estimating is the art or science (?) of guessing, and the man who is a good hand at the latter is a good estimator.

As long as you have the human element entering into the work you will not be able to get rid of this guessing aspect, but the more it can be eliminated the nearer you approach to the real scientific estimate.

All new estimates are made up from the estimator's knowledge obtained from previous similar work, therefore the desirability of keeping accurate records is at once apparent.

This is the gist of the whole matter, and according to the way this information is first obtained and tabulated depends entirely the efficiency of the department. Naturally of prime importance are the orders actually carried out, but estimates which have not matured are also of value in a comparative sense.

From this it appears that the first thing to arrive at is an efficient cost system and this must be designed to suit the particular works. One of the greatest stumbling blocks is the obtaining of correct information from the men in the works of the actual time they have been employed on a particular order, and this requires special thought for every works.

The following are a few of the writer's experiences which may serve to point out what to avoid or adopt.

(1) A firm manufacturing steel buildings and general structural work. The majority of the work could be divided into a number of distinct classes, such as (a) roof trusses; (b) open sheds; (c) closed sheds; (d) bridges, etc.

The number of enquiries received for these lines probably ran to about five or six per day, and they were dealt with without any reference at all to previous work done, although quite an elaborate cost system was in vogue.

During the course of twelve months quite a large number of enquiries of a similar nature would be received.

The weight of the metal in the structure would be arrived at by each man jumping at the sections with the consequence that sometimes they were too light and at others too heavy.

The writer found this was due to the fact that owing to the large number of enquiries coming in there was no time to investigate each case properly if they were all to be quoted for.

The first step decided on was to make once and for all a standard series of roof trusses within the limits of the usual work. These were completed for three different styles of roof coverings in steps of two feet from 18 ft. to 54 ft., and for three different spacings of the trusses apart.

This was really carried out in a scientific manner and could be relied upon, thus giving a close figure for the weight of the material.

Next it was decided to tabulate all the estimates except those of a special character, dividing them up into about eight or ten classes, and recording all the principal features such as total weight, price per ton for manufacture, point of delivery, price for erection, basis price of raw material, outline dimensions, price per square and cubic foot for buildings, and reference to estimate and drawing number so that they could be turned up if necessary.

After this scheme had been in operation a little while the value began to be apparent, as frequently it was found to be possible to quote direct from the record, say, on the basis of a price per square or cubic foot, or a price per pound.

This scheme was particularly useful in those cases where the work did not appeal to the firm, but at the same time wished to quote a figure in order that they should not be debarred from future work, and as the process involved did not occupy much time it enabled them to devote a larger proportion of time to the desirable enquiries.

---

[*] Chief Draughtsman, McKinnon, Holmes & Company, Sherbrooke, Que.

The results of the cost system mentioned previously were also tabulated in a similar manner, and the final result as may be imagined raised the proportion of orders obtained to quotations sent out by quite a large percentage.

(2) Another works manufacturing a miscellaneous character of mechanical work was treated in a similar manner. In this case all castings were obtained from another works and as these formed quite a large proportion of the output it was a comparatively easy matter with a little system to get accurate results on this portion of the work.

Patterns were standardized as far as possible and a good system of reference marks adopted, these being printed in the castings so that it was easy to check them off. All invoices for castings were demanded with separate weights for each particular type so that they could be entered up into the pattern register and on the drawings. This enabled the estimating to be very close as in a general way the calculation of the weight of a casting if at all irregular is quite a tedious job, and also more or less uncertain. Changes on patterns could be readily estimated taking the actual weight of the original pattern as a basis.

The time occupied in machining or fitting the work up in the shop was taken on the card system. That is, each man would be provided with a card for a particular order which he immediately punched in the clock and as soon as this job was completed the card would be punched again, and with each new order a new card would be issued so that it was practically impossible for any of the men to enter their time up to the wrong contract.

These cards were handled by the cost clerk and the resulting information handed over to the estimator.

Another important feature in estimating is the percentage of overhead charges, or burden that a particular class of work should carry. This item includes management, clerical and drawing office staff, outside representation, foremen, power, light, heat, interest on capital, wear and tear of machinery, etc.

The usual procedure is to take the average of these amounts for the previous three or five years working and divide this total by the average tonnage.

This practice hardly seems a good one to the writer. The general effect appears to be that the burden on plain, simple, straightforward work is too heavy and on the more complicated orders too light, and it results in a general way in obtaining work mostly of the latter class.

Perhaps the better method is to make monthly averages instead and take note of the class of work being done during each period. This would enable a much nearer estimate to be made of the conditions likely to result for a particular order.

In works running several departments it is desirable that the running expenses for each should be kept separately.

The last point I wish to call attention to is connected with the purchase of material or manufactured parts made or supplied by other firms.

Many a good estimate has been wrecked by a final jump in the dark for the cost of something which might have been properly enquired for if the necessary steps had been taken when the enquiry came in instead of waiting till the last minute and finding it impossible to get the information on such short notice.

In addition a good system of tabulation for the results of these tentative enquiries and for actual purchases made will more than repay for the time expended.

To sum up the whole thing in a few words:—"Systematise in a scientific way," and having accomplished this you will be surprised to find how smoothly everything works.

Methods of Contract Estimating

In many cases it has been the custom of contractors when tendering for contracts to figure in their own method the cost of their several departments of work in building operations, says a writer in The National Builder. The result frequently has been that there is a great disparity between the amounts of the tenders returned; and being generally lump sum offers, the owners or parties building have no assurance or way of satisfying themselves that the estimates have been carefully and accurately prepared. There are various methods of measuring adopted, according to the locality in which the building is proposed to be erected. In some localities the builders or contractors measure their work according to certain rules known to themselves; but this practice does not give a basis that would be applicable in every locality. Now, a system of measurement that can be uniformly adopted and practiced in any locality is one which would be of great value in giving data for finding the various items of details. Such a system has already been introduced into America, but is not yet uniformly adopted. In some future articles this system may be explained and illustrated.

There is another method known as "cubing" which is sometimes adopted. But it requires considerable experience in the estimator to come to anything like an approximate cost of the work measured and computed by this method. Usually the extreme length of the building multiplied by the extreme width and then by the height from the bottom of foundation to wallhead will give the cubic content in feet. Where there is a pedimented roof, usually the length and breadth of the building is multiplied by half the height to find cubical content. After the cubical content is obtained, the price per cubic foot is calculated upon the basis of the total cost of a building of a similar character, ascertained at the price per cubic foot.

Another simple method of ascertaining the cost of a building is by taking the contents of each flat or storey. Thus, we take the superficial content of the flooring, the lath and straps on walls, the lath on ceilings, the number of windows and doors with their trimmings, and the sundries of each flat separate. The items of each flat are calculated at current rates, and if the flats are similar in construction they can be multiplied by the number.

These are some of the methods that may be adopted to ascertain an approximate estimate of what a building will cost; but the most reliable method is by the adoption of a uniform system of measurement having well-defined and formulated rules that will give justice to both owner and contractor alike.

A report from Calgary states that a syndicate of local and Minneapolis capitalists, of which O. C. Devenish is the head, will shortly commence the erection of the largest flour mill in the British Empire. It will be built in four units, to cost $1,400,000 each, and when all the units are completed, will have a capacity of 6,000 barrels of flour per day.

The Design of Imhoff Sewage Plants*

Preliminary Screens and Proportioning of Grit Chambers—Settling Compartment, Velocity of Flow, Detention Period—Pumping Sludge and Drying Beds

THE methods of design of Imhoff sewage tanks presented in this article are based upon seven years of practical experience in the Emscher District of Germany. For the conditions that exist in this district these methods have undoubtedly proved satisfactory. Twenty-two Imhoff plants, consisting of one hundred and twenty tanks, have already been constructed in the district under varying conditions and four more plants with thirty tanks are to be constructed this year. There are now in Germany about one hundred plants using this system.

The data herein given should not be used indiscriminately. Each individual case must be carefully studied beforehand and the design so modified as to fit that case. This can be done intelligently in most cases only in the light of expert experience.

Fundamental Data

First to be considered in the design of any disposal plant is the question of whether the sewerage system is upon the combined or upon the separate plan. If it is upon the combined plan more sludge will come to the plant than under the separate system, and this sludge will contain an appreciable quantity of detritus. It is necessary, therefore, to take due account of this increased sludge and of the detritus in designing the size of the sludge chamber and in determining whether or not a grit chamber should be placed before the tanks.

Important, too, is the matter of storm flows. Usually where Imhoff tanks are installed under the combined system a storm-water overflow is provided and so arranged that a given number of times the dry-weather flow is permitted to enter the plant, while the remaining excess overflows directly into the stream, or, as has been found desirable in some cases, it is caused to enter a storm-water basin. This basin has, for example, in the case of Essen Nord, a detention period of twenty minutes for storm flows of six times the dry-weather flow, at which time half of this sixfold flow enters the Imhoff tanks and the other half the stormater basin. In the exceptional cases where the storm flow is even greater than sixfold dry-weather flow the dilution is considered sufficiently great to permit the excess to flow directly into the stream. After the storm the sludge from the storm-water basin is pumped back into the influent channel, taking the usual course through the settling tanks.

Where the separate system is in use the amount of sludge received is considerably less and the amount of detritus is reduced to a minimum. Hence under this system the sludge-room capacity is lessened correspondingly and a grit chamber is generally omitted.

The next factor considered in the design of the plant is the amount and character of the sewage; which latter affects greatly the time necessary for optimum sedimentation and the amount of this sedimentation. If the sewage is very dilute and contains no coagulating chemicals the detention period is made longer than if the sewage is very concentrated and contains such chemicals as iron wastes. Again, the production of hydrates due to the presence of chemical wastes generally increases the amount of sludge sufficiently to affect the size of the sludge chamber.

It is the practice in Germany to determine the amount of sludge expected in a given plant upon the basis of population rather than upon the volumes of sewage, and this basis of estimation has been found in most cases to be much the more accurate of the two. The population figure used in the design is generally that expected in five years.

It is important in any construction work to study the local conditions. If the ground material is of such a character that the ground-water table may be easily lowered, then the plant may be so designed as to permit of open-pit construction. If however, the material is quicksand, or other conditions make the lowering of the ground-water table during construction difficult, then it may be advisable to sink the tanks as caissons.

Deep vs. Shallow Tanks

It is logical to conclude that in order to attain the same degree of decomposition with shallower tanks it is simply necessary to increase the time of decomposition. In order to increase the time of decomposition, however, the sludge room must be made larger. Hence the tendency will be to expand it laterally, and this, with present designs, leads to a greater cross-section area of sludge room per unit of slot feeding fresh sludge—in other words, the thoroughness with which the incoming particles of fresh sludge are distributed over the cross-section of sludge room is lessened.

The fall necessary in Imhoff plants between the influent and effluent channels may be placed as low as 1 to 2 ft. in cases where grit chambers are not used. Where grit chambers are used, however, and it is desired to drain the retained grit by gravity, a total fall of from 3 to 4 ft. in the plant is necessary. To avoid this additional fall, however, the grit drainage water may be pumped out.

Preliminary Screens

The object of the preliminary screens is to prevent the larger solid substances from getting into the sludge room and clogging the sludge pipe. The clearance used in these coarse screens is usually 2 to 2½ in. The reason for such large clearance is to prevent the retention of faecal matters which should logically enter the tanks.

The total width of the screen chamber is usually made 1½ to 2 times the width of the influent channel, so as to minimize friction and consequent damming. Therefore it is considered advisable, especially in large plants, in order to maintain the necessary velocity to prevent sedimentation, either to raise the invert under the screens, so as to reduce the cross-section to that in the influent channel, or to increase the slope under the invert.

The inclination of the screens is about 1 vertical to 3or 4 horizontal. This is a greater inclination than has been the practice elsewhere; but this greater inclination has many advantages. First, it insures a lessened encroachment upon the fluid cross-section, since the more the bars are inclined toward the horizontal the less is their vertical cross-section. Again, the useful superficial area of the screens is increased by this greater inclination. Then again, the flow of sewage tends to shove the entrained matter toward the upper part of the screen and thus minimizes clogging. Finally, the cleaning of the screen is facilitated by the greater inclination.

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*Abstract of a series of articles by Leslie C. Frank, Assistant Engineer, Baltimore Sewerage Commission, in the Engineering Record.

The cross-section of the bars depends upon the necessity for stability and upon the need of minimizing clogging. In this district the cross-section shown in the drawing has been much used, as it provides a maximum stability, due to the bulbous head, and insures minimum clogging, due to the narrow web.

The lateral brace bars are generally placed at the invert end of the screen, at a point somewhat above the water surface, and at the upper end of the screen. None should be placed within the fluid cross-section, as then the entrained matters are not easily removed.

A screen by-pass is usually provided in the larger plants of the Emscher district, as shown in the drawing. Its purpose is to prevent flooding of the plant if the screen proper should accidentally become superclogged, which may happen during a rainstorm at night, when there may be no attendants at the plant. The screen is simply hand cleaned as often as necessary with a suitable rake.

Grit Chamber

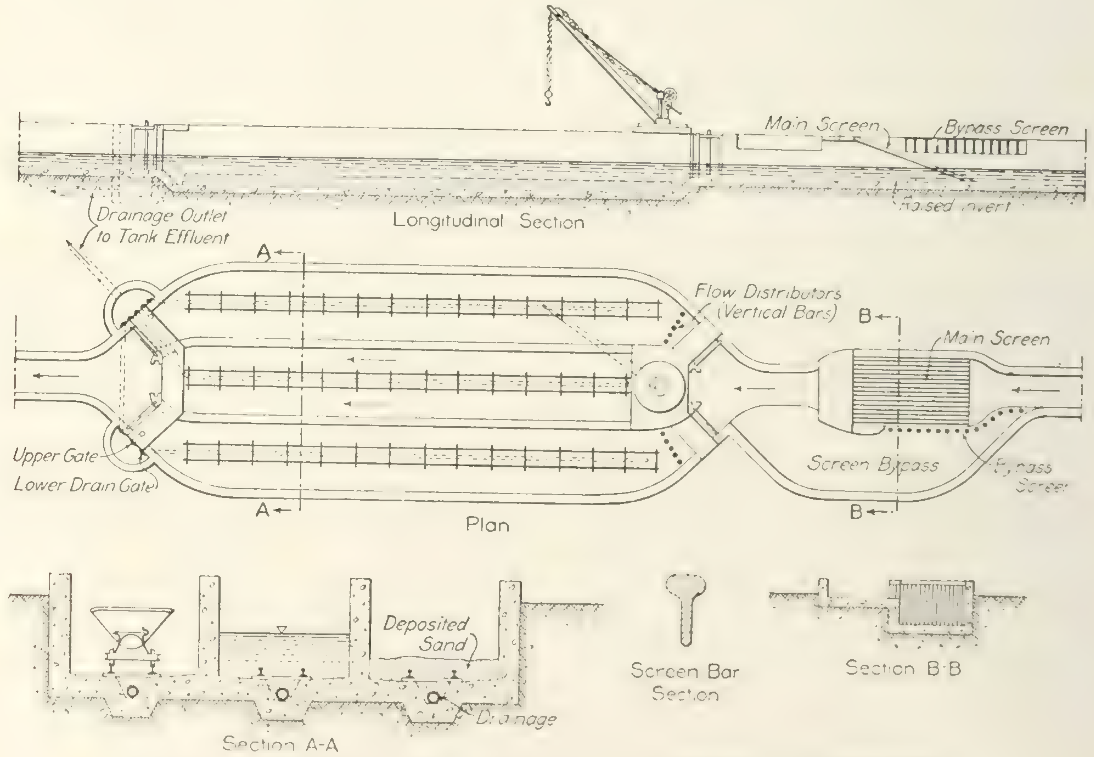
The object of the grit chamber is to retain the harmless mineral suspended content—chiefly street grit—of the sewage. Such suspended mineral matter would merely lessen the capacity of the sludge chamber if it is not previously removed from the sewage, and in addition it is liable, when arriving in considerable volumes, to result in stoppage of the sludge-discharge system. Such harmful volumes of grit do not generally appear where the separate system of sewerage is in use, as has been previously mentioned, and therefore in this case the grit chamber is usually omitted. Neither are grit chambers included in the case of small plants on the combined system where the conditions are such as to insure small amounts of grit.

In the sewer the heavier sand particles are being rolled along the bottom and the lighter ones repeatedly thrown back into the lower part of the fluid cross-section. In the grit chamber the velocity of flow should be so reduced that these lighter particles are no longer thrown back, but tend to roll along the bottom or remain quiet. Such an average velocity has been found by experience to be about 1 ft. per second.

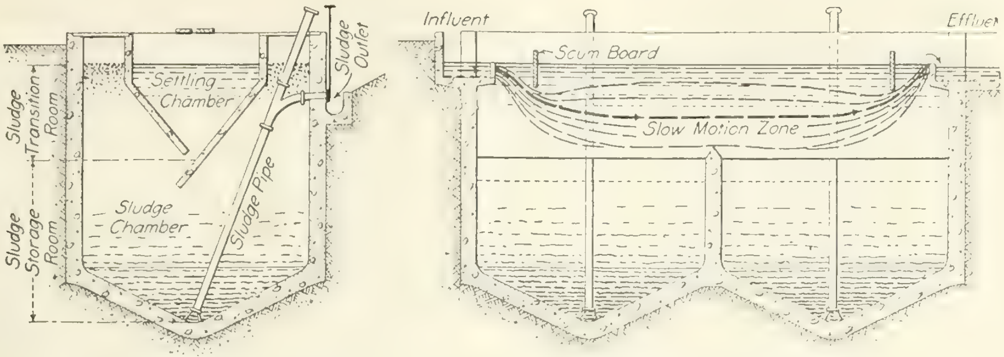
The depth of the grit chamber is limited by the necessity of preventing the deposit of organic sludge. From this standpoint the difference between a grit chamber and a sedimentation chamber in theory may be regarded to be the fact that in the sedimentation chamber there is provided a lower "slow-motion zone" in which the settling organic sludge particles may be entrapped, while in the grit chamber this slow-motion zone is simply omitted so as to prevent such entrapping. Therefore a properly constructed grit chamber should be essentially shallow.

The length of the chamber should be such as to insure the deposit of an optimum per cent. of the sand and to provide sufficient sand-storage volume to avoid the necessity for too frequent cleaning.

The invert of each grit chamber unit is usually provided with a longitudinally placed drainage pipe, closed at the outlet end by a valve. This drainage pipe is placed in a depression in the grit chamber invert and surrounded, up to the level of the invert, with graded slag or gravel, the top layer being sand. The pipe is usually ordinary agricultural drain tile, placed loosely end to end. The grit chamber is composed of several units (generally three). The extra units are provided



Details of preliminary screens, bypass and grit chamber for typical plant.



Longitudinal-horizontal-flow tank of average European proportions.

for two main reasons—(1) to permit taking a unit out of operation while it is being cleaned and still retain the grit chamber function; (2) so that during storm flows more than one unit may be taken in operation. Otherwise the velocity of flow in that one unit would be so increased as to flush the sand it had previously retained into the tanks. In the past where grit chambers have been designed for maximum storm flow it was found that putrescible sludge settled out with the grit during ordinary flows, and where grit chambers were designed for ordinary flows maximum storm flows flushed out the sand. It is advisable, therefore, to provide a number of units, each one designed for ordinary flows.

In the invert of the larger grit chambers are usually placed tracks for hand cars. In emptying the grit chamber the hand cars are loaded with grit and then shoved to the end of the chamber, where the container is lifted out by means of a hand crane.

The Imhoff tanks proper consist of settling chambers suspended over sludge-digestion chambers, the sludge entering the sludge-digestion chamber through slots in the bottom of the settling chamber.

There are three different designs of sedimentation chambers. The first is a longitudinal-horizontal-flow tank, and is the one most in use. The second is a downward-and-upward-flow tank. The third is a radial-horizontal-flow tank. Neither of the last two designs has been adopted extensively as yet.

The downward-and-upward-flow tank was designed because it was thought that thereby a better cross-sectional distribution of flow might be secured, but the results of the operation of this tank on a large scale seem to indicate that its efficiency is not as good as that of the longitudinal-horizontal-flow tank.

Radial-Flow Tank

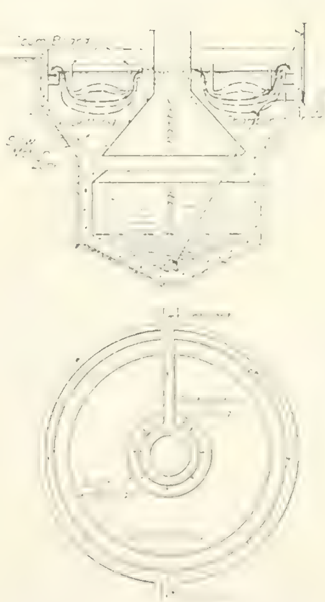
The first radial-horizontal-flow tank was constructed at Altenessen, and there are no operation data as yet. In this design the deeply penetrating baffle, causing downward and upward flow in the above-mentioned tank, has been removed and shallow scum-boards substituted therefor. A possible difficulty is that the radial direction of flow and consequent limitation of length of flow line may result in this flow line being too short to give the upper, rapidly moving currents sufficient opportunity to unload their sediment into the "slow-motion zone." It is obvious that the near surface velocities are not decreased in direct ratio to the decrease in length of tank, and hence these upper rapidly moving currents might have a detention period much too short for efficient sedimentation.

A real advantage in the radial-horizontal-flow type is that here the velocity of flow, in order to provide the proper detention period, must necessarily be very low, and this fact will probably permit a greater amount of overloading than in the case of long-flow-line tanks, before critical velocities are reached.

As the accompanying drawings show, the settling chamber is inclosed by thin walls suspended in the main tank. The size of the settling chamber depends principally upon the necessary detention period and upon the volume of sewage. Generally, in the Emscher District the average daily volume of sewage is considered to flow off in fourteen hours. In America this is often taken at eighteen hours. The reason for this assumption is, of course, the relatively small night flow. From the thus determined hourly sewage flow and the number of hours' detention period the necessary volume of settling chamber is derived.

The detention period depends upon the character of the sewage to be treated. If the sewage contains a large quantity of suspended matters or coagulating chemicals, for example, a small detention period will suffice.

It is also necessary to limit the length of the settling-chamber flow line, because if this is made too

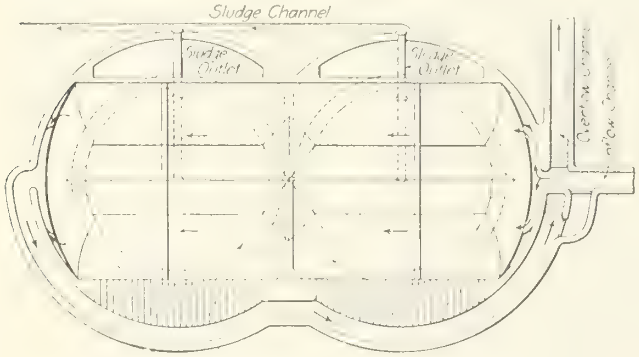


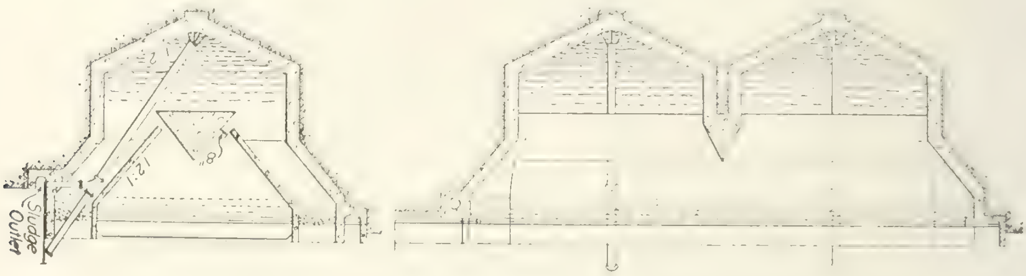
Radial-horizontal-flow tank.

long the velocity necessary to give the proper detention period will be high enough to induce whirling currents and thus hinder sedimentation. Experience has shown that an average velocity of from 0.1 to 0.13 ft. per second is a reasonable maximum limit above which whirling is liable to occur, but in the design of Imhoff tanks it has been the practice not to exceed for dry-weather flow 0.03 ft. per second, so that the upper limit of 0.1 ft. is just reached when the storm-water dilution is threefold.

Cross-Section of Tank

With the length determined the previously determined necessary tank volume will give the necessary tank cross-section. From the necessary cross-section the width and depth may be determined. In general, the width and depth of the tank should be governed by the necessity of proper distribution of flow. The movement of sewage in a settling tank has often been studied and described. One of the occompany drawings shows approximately the direction, location and relative intensity of stream lines in Imhoff tanks. It will be clear that the velocity of flow decreases toward the lower part of a properly designed tank. The velocity in the vicinity of the slot must be sufficiently low so as not to stir up the sludge particles accumulated there, and should constitute the previously mentioned slow-motion zone. For this reason deep-reaching baffle boards are not advisable, and experience in this district has fully demonstrated this. The tank, therefore, should not be to shallow as to encroach upon this slow-motion zone and thus inhibit the passage of the settling particles through the slot. On the other hand, the tank should not be so deep as to inhibit proper vertical distribution of flow. In the former case the maximum possible percentage of settleable solids will not be removed, and in the latter case part of the volume of the tank will be ineffective.





Longitudinal-horizontal-flow tank of average American proportions.

Inlets and Outlets

Since one of the most vital parts of settling-chamber design is the securing of a maximum efficiency of distribution over the chamber cross-section, the inlet and outlet ends of the chamber assume a corresponding importance. The current practice to reverse periodically the flow in Imhoff tanks of more than one sludge chamber, so as to obtain a uniform sludge in the various sludge chambers, makes it necessary in these cases that the channels serving the tanks be so constructed as to act alternately as influent and effluent channels. Hence their inverts must be at the same elevation. In addition, the weirs at the ends of the tanks must act alternately as inflow distributors and effluent weirs. Hence both of these weirs must be at the same elevation. Since the sewage flows over the effluent weir in a comparatively thin sheet the elevation of this weir practically determines the elevation of the sewage in the influent channel. This in turn determines with a given width of channel the fluid cross-section in the channel, and hence, for a given dry-weather flow, the velocity in the influent channel.

Uniform Flow

It has often been attempted in the past to design the influent and effluent ends of a sedimentation tank in such a way as to secure uniform velocities of flow throughout the fluid cross-section of the tank. As has been previously explained, however, the existence of a slow-motion zone at the bottom of the sedimentation chamber is imperative in order that the settling sludge particles may be trapped. The velocity should be considerably lower than the critical swirling velocity, and hence there is no reason why the velocities in the upper part of the tank may not be higher, within limits, than in the lower parts of the tank. It is simply necessary for the upper currents to have sufficient time to drop their load of suspended matter beyond the "pull" of the effluent device. Therefore the effluent device should logically be placed as high as possible—preferably a weir.

The minimum width of slot is governed by the necessity of preventing choking, and the maximum width of slot is governed by the necessity of preventing undue diffusion surface.

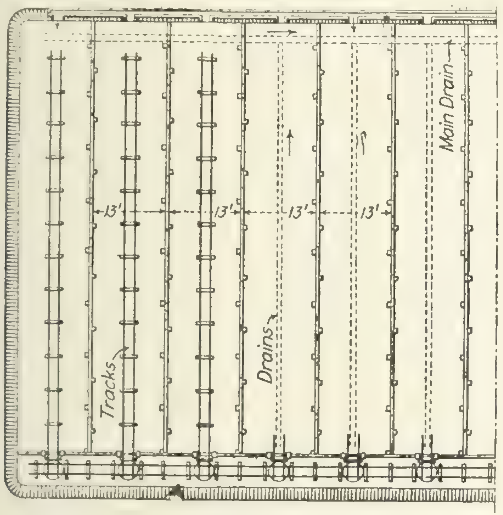
Scum Boards and Baffles

The penetration of scum boards under the water surface should not be so great as to render ineffective part of the upper volume of the chamber, or immoderately to increase the velocity in the lower slow-motion zone. In the Emscher District they are made to penetrate 12 to 16 in., and they usually project about 12 in. above the water surface.

Baffles are not considered advisable either in the upper or lower part of the sedimentation chamber. They have been tried, both from the standpoint of better flow distribution and in order to promote the production of the slow-motion zone. The conclusion has been that instead of this they decrease the cross-section of flow and tend to produce subcurrents, thereby hindering sedimentation rather than promoting it. It is true that some of the sewage flows through the tank in a much shorter period than the theoretical detention period.

Sludge Treatment

Sludge treatment, generally conceded to be the most difficult part of sewage disposal, differentiates Imhoff plants from other sewage disposal plants. Unfortunately, only little is known about the process occurring in the sludge room. Investigations are being made concerning the chemical and biological parts of the process. A universal conception of the physical part of the process is that there is normally a quantity of sludge lying at the bottom generating gas within its "live" particles. At irregular intervals part of the mass of the sludge may rise to the top in a body and remain there till it has given up sufficient of its gas to settle again. Hence, whether to accommodate the rising and falling particles or to provide room for the temporary floating position of a mass of the sludge, it is necessary to have above the plane of the slot in the sludge chamber a certain amount of "transition" space. The sludge chamber, therefore, may be regarded as composed of two parts—that part below the slot, or the sludge-storage room, and that part above the slot and adjacent to the settling chamber, which may be called the sludge-transition room.



Plan of Sludge-Drying Bed

The storage room is one of the most vital parts of an Imhoff plant. Upon its dimensions and shape depends the digestion period which the sludge will receive, and to a large extent the condition of the rotted sludge discharged. It is, therefore, particularly important that the data upon which the sludge-storage room is based in design be as far as possible dependable.

Depth and Sludge Digestion

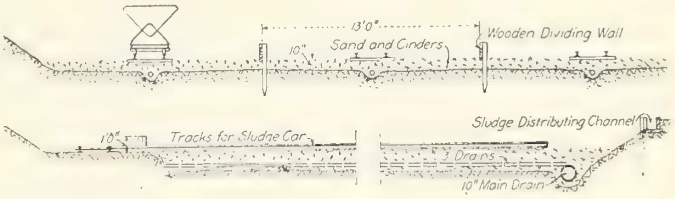
The depth of the sludge chamber seems to have an influence upon the sludge-digestion process. This influence has been but little understood, but it has been continually maintained that shallow tanks yield a poorer quality of sludge than deep tanks. A depth of tank which has most been used in the Emscher District is about 30 ft. from water surface to bottom of tank. A few have been made 24 and 27 ft. deep. In some cases, however, it may be advisable, for economic reasons, to adopt tanks as shallow as 20 ft., deliberately preparing to accept a somewhat poorer grade of sludge. It has not been proved that a tank of 20 ft. or even less in depth will not in many cases yield a sufficiently good sludge for all practical purposes, but it is now reasonably clear that a 30-ft. depth is sufficient.

The slope of the bottom of the sludge room should be at least 1 vertical to 2 horizontal. This is based on the assumption that flushing rings are inserted.

The sludge-transition room, or upper part of the sludge chamber, is designed to accommodate the sludge which is temporarily lighter than the sludge water and the scum. There are no data from which the minimum size of this room may be inferred. It is customary in Germany to make the transition room about one-half as large as the storage room. The surface must obviously be large enough to accommodate the scum properly, and, in addition, to permit of entrance by workmen into the lower part of the sludge chamber. In European practice a good average figure for the ratio between transition room surface and total sludge-room surface is 1:3 to 1:4. It is impossible to say with present available information how small a space will suffice; 1:10 has been used in a few cases with success.

Discharging Sludge

The discharge of sludge from the sludge chamber has been found to be most simply and cheaply accomplished by means of a pipe reaching nearly to the apex of the conical bottom of the tank and having its outlet far enough below the water level to provide sufficient hydraulic head to force out the sludge. The pipe is usually made about 8 in. in diameter, its outlet being from 4 to 6 ft. below the water level. The main part of the pipe is, whenever possible, made straight and projected to above the tank walls so as to permit of inspection and cleaning. The hydraulic gradient for a sludge pipe 8 in. in diameter should be about 12 to 16 per cent., in order to be reasonably sure of minimum clogging. Where less than this gradient is used stoppage is likely to occur.



Section of sludge bed showing dividing walls and tracks.

Sludge Disposal

Sludge taken from Imhoff plants is generally disposed of in Germany by drying upon underdrainage beds of porous material. Wherever possible, of course, the sludge is transported to these drying beds by gravity. The slope of open sludge channels is usually made about 2 per cent. The minimum width of the sludge channel is dependent upon the necessity of cleaning it after each charge of sludge is passed through. In case closed pipes are used for gravity flow, which is not recommended, they should be made of such size as not to increase the friction head; otherwise the 2 per cent. slope will have to be increased correspondingly.

Pumping Sludge

When the available fall is less than about 8.5 ft. it is generally necessary to lift the sludge to the drying beds. Various methods of sludge lifting present themselves for consideration. These are: Plunger pumps, centrifugal pumps, air-lift pumps, compressed-air chambers, and hand-membrane pumps. The important thing in sludge pumping seems to be the retention of the gases of decomposition. As has often been stated in articles upon the drying of decomposed sludge, the reason for the rapidity of the drying is that the expansion of the minute gas bubbles, upon being removed from a pressure of, say, 2 atmospheres at the bottom of the tank to a pressure of 1 atmosphere at the surface causes the sludge to be lighter than water. When the sludge is placed upon the sludge-drying bed, therefore, it soon floats on its own water content, and this water, being free, quickly passes away through the porous drying-bed material, leaving the sludge spadable in a few days. Therefore, whatever method of sludge lifting is employed it should be such as not to remove any of these gases of decomposition.

Plunger Pumps.—Plunger pumps have proved to be well adapted to sludge lifting where they are placed sufficiently low so that the sludge from the tanks may enter the pump by gravity, and not have to be sucked in; this suction tends to remove the gases. The pump should be so simple in construction as to insure minimum operation difficulties from the passage of solid particles of reasonable size. In order to avoid stoppage from larger particles a screen of about ½-in. clearance should be placed before the pump.

Centrifugal Pumps.—Centrifugal pumps are very efficient and easy to operate, but seem to have the disadvantage of stirring the sludge too violently and tending to prematurely disengage from each other and aggregate the gas and sludge particles, thus, as above indicated, retarding drying.

Air-Lift Pumps.—Aair-lift pumps have not as yet been used extensively. It is possible that under certain conditions air-lift pumps may be installed directly in the sludge room without an intervening sludge well. This has been tried in the Emscher District and found satisfactory. An advantage of air-lift pumps is believed to be the possible mingling of the compressed air particles with the sludge and thus promoting the drying operation.

Compression Chambers.—Another possible method of lifting sludge is by means of compression chambers. When the sludge from one or more sludge chambers is collected in an air-tight drum the admission of compressed air to the drum is a simple means of forcing the sludge to the drying beds. The great advantage of such a method is the practical elimination of clogging and the absolute non-interference with the gas content of the sludge.

Hand Membrane Pumps.—Hand membrane pumps are sometimes used in small plants. The pipes used in lifting sludge should be of such diameter that the velocity will be sufficiently great to avoid sedimentation.

Drying Beds

The sludge-drying beds used in the Emscher district have proved extremely well adapted to their purpose. The size of the drying beds depends upon the population to be served, climate, and character of the sludge.

The German drying beds are usually divided into units each 13 ft. wide and of sufficient length to permit of alteration in operation. The depth of the main drainage layer of the beds is usually about 8 in. and is graded from 4 in. material at the bottom to ¼ in. material at the top. On top of this layer is usually placed about 2 in. of ashes or sand, some of which generally remains sticking to the removed sludge cake, and thus has to be replaced from time to time, often by the sand from the grit chambers. As shown in the accompanying drawing there is placed in a depression down the middle of each unit a line of agricultural drain tile about 3 in. in diameter, connected to an 8 to 12 in. main collector. The slope of these drain tile is made about 1 to 200.

The division walls between the units of the drying bed were previously always made of planks nailed to short posts, but recently a number of plants have been constructed with concrete-slab division walls. Down the middle of each unit is also placed a narrow-gage track for small dump cars, to facilitate the removal of the dried-sludge cake.

The sludge-bed surface must, of course, be made horizontal so as to insure a sludge layer of uniform thickness. The thickness of sludge layer is about 10 in., and in drying this reduces to about 7 in.

Biological Purification

In conclusion it will be pertinent to comment upon the relation of Imhoff clarification plants to biological purification. In general, it may be stated that the design of Imhoff plants is not affected by the inclusion of biological purification. There may be cases in which the advisability of a somewhat longer detention period, or of the use of chemical precipitation, so as to relieve the filters as far as possible, should be investigated, but it is believed that these cases will be extremely rare.

Cases may occur in which an overflow weir should be placed between the preliminary clarification works and the filters in order to avoid the necessity of designing the filters for storm flow, or to prevent their temporary overloading. This depends upon whether the system of sewerage is upon the separate or upon the combined plan and whether or not the purification of the sewage is carried out from the standpoint of nuisance or from the standpoint of disease. If the sewerage system is on the separate plan, obviously no overflow weir will be used. If the system is on the combined plan and the purification of the sewage is carried out from the standpoint of disease prevention, then an overflow weir would be illogical, for during the times of storm flow the safety element would be absent. If, however, the biological purification of the sewage is carried out merely because nuisance may result during dry-weather flow even if the sewage has received preliminary clarification, then the inclusion of the overflow weir may be advisable.

Humus

Where biological filtration is employed the humus in the effluent is usually retained in final clarification tanks. This humus is generally putrescible, and, therefore, the tanks should be so arranged as to separate the sedimentation chamber from the sludge chamber, just as in the case of preliminary clarification.

It has been observed in experimental as well as practical plants in Germany that the humus retained in final clarification tanks does not decompose as rapidly as preliminary clarification sludge. The reason for this is not clearly understood, but it is believed in the Emscher District that it may be due to the fact that the rapid decomposition taking place in preliminary Imhoff sludge chambers is essentially anaerobic in character, whereas in the humus coming from trickling filters the aerobic bacteria are dominant and must be eliminated before the rapid anaerobic action can begin. Unless some means were adopted, therefore, to increase the rapidity of decomposition, the sludge chambers would have to be made abnormally large. This can be done by inoculating the humus with properly decomposing "preliminary" sludge. The Emscher Federation has done this at Holzwickede by making the preliminary and final Imhoff tanks interchangeable. This was possible because at Holzwickede the sewage has to be pumped into the sprinkling filter and so the preliminary and final tanks could be placed at the same elevation. Where trickling filters are operated by gravity the inoculation of the humus may be accomplished either by periodically admitting preliminary tank sludge to the final sludge chambers or by periodically pumping the retained humus back into the influent of the preliminary tanks.

Usually one hour's detention will suffice for final clarification tanks, as the sprinkling filter humus settles rapidly. The size of the sludge chamber depends altogether upon the method of treating the sludge. Generally the humus from trickling filters may be taken at one-quarter to one-half the amount of preliminary sludge.

Professor Starkey on Sewage Disposal

PROFESSOR T. A. Starkey, of McGill University, in the course of an address to the Montreal Society of Chemical Industry, dealt with various schemes for sewage disposal. In the preliminary steps for sewage disposal there were, he said, three systems—sedimentation tanks, chemical precipitation and septic tanks. All these preliminary treatments had one object in view, namely, the elimination of solid matter from the sewage. By accomplishing this, a clear liquid could be obtained, free from animal impurities, except those held in solution, which could easily be disposed of in the secondary beds by oxygen-breathing germs, called acrobes, which are found on the contact beds or percolating filters. In one case mentioned, the speaker told how this work of destroying the organic matter contained in the liquid fed them was accomplished by these acrobes in three and one-half minutes, the soluble matter contained in the sewage being turned into stable chemical salts, which impart no odor, flavor or other characteristic—appreciable to the ordinary senses—to the water in which they are contained. These germs, which are so powerful to destroy the organic matter of the sewage, were contained in that sewage itself, the contact beds or percolating filters being merely devices whereby to house the maximum number of these germs in the smallest space.

A recent scheme for the destruction of germs in sewage by the introduction of chloride of lime would have to follow, he said, after the liquid had been cleared of solids and organic matter, else it would also kill the germs which destroyed this matter. He did not recommend its use in Montreal, as, he said, the liquid which would pass off the contact beds, while full of germs, would contain so little food for these that they would in any event soon become eliminated.

He would judge from the character and analysis of the average Montreal sewage that a percolating filter, followed by a moderate elimination of sludge, would appear to be the most suitable system of dealing with local conditions. It was a matter of opinion as to whether or not the germs should then be killed off. In his opinion this was not necessary.

What will be Vancouver's second tallest building is rapidly taking form. The structure will be fifteen storeys in height and will cost over $700,000. The building is of steel frame construction. In finishing the building the novel system will be adopted of treating each two storeys as a separate building which will mean that many more men will be able to work at once than is generally the case and that every floor will be completed almost simultaneously. It is expected that the building will be ready for occupation by next July. Messrs. Russell, Babcock & Rice designed the building for Mr. Weart.

Effect of Salts on Strength of Concrete

TESTS to determine the effect of sodium chloride and calcium chloride, separately and together, upon 1:2:4 concrete were made at the University of Wisconsin during the winter and spring of 1912 by Messrs. H. E. Pulver and S. E. Johnson, instructors in mechanics. The test pieces were cured at temperatures of from 60 to 70 deg. Fahr. and below freezing. The results have been published in the "Wisconsin Engineer" by Mr. Pulver.

All mix was by volume and the salts were dissolved in the mixing water. The test pieces were 4-in. cubes, and those cured at a temperature below freezing were broken after fourteen and sixty days, while those cured at normal room temperatures were broken after fourteen, sixty and three hundred and sixty days. Four pieces were tested at each age for each batch of concrete. Atlas Portland cement was used, and to prevent variation in the quality it was mixed thoroughly in the beginning and a sufficient quantity stored in airtight cans.

The test curves show that as the percentage of $NaCl$ is increased there is a nearly straight-line decrease in the strength of the concrete cured under normal conditions. The effect of $NaCl$ alone, when added to concrete cured at low temperature, is probably to reduce the freezing temperature, and hence retard the freezing of the concrete, thus permitting of its setting and hardening. The curves show an increase in strength for the addition of $NaCl$ up to 12 per cent., after which there is a decrease. It may be that beyond 12 per cent. the weakening of the concrete due to the excess of $NaCl$ more than offsets the strengthening due to the reduction of the freezing temperature.

When $CaCl_2$ alone is added to the concrete, cured either at normal or low temperatures, the effect is to increase the strength up to about 4 per cent. $CaCl_2$, at which point the maximum strength seems to be obtained. This increase in the strength of the concrete may be due to the acceleration of the setting of the cement by the $CaCl_2$. Serious disintegration was observed on the surfaces of the cubes cured at low temperatures with 6, 8 and 10 per cent. of the $CaCl_2$. This disintegration did not appear on any of the cubes cured at normal temperature or where $NaCl$ was used.

With concrete at low temperatures, the best effect seems to be obtained by using both $NaCl$ and $CaCl_2$ in the mixing water. It was noted that a 2 per cent. $CaCl_2$ and 9 per cent. $NaCl$ mixture appears to give the most satisfactory results. For concrete cured at low temperatures this mixture gives about as much strength as any of the mixtures tried, and for the concrete cured normally there was not a very great reduction in strength due to the addition of the salts in those percentages.

All tests were made with only one brand of cement. It is probable that there would be some variation in the results with other brands, but it is not thought that this variation would be great enough to affect the general conclusions. It is also possible that some brands of common salt might contain a sufficiently high percentage of calcium sulphate to affect the results to some extent.

Problems Involved in Driving Long and Deeply Overlaid Tunnels*

THE great improvement in tunnelling methods and machinery made in the last decade is responsible for the large development that has taken place in the railroad world in this and other countries. Mountain ranges which heretofore had defied the railroad pioneer are being pierced at their very base and must yield to the slow but irresistible work of the tunnel driver. In the Alpine region the Simplon and Loetschberg tunnels have proved that length combined with great overlying depth is no longer an insurmountable obstacle, and that a high rate of progress can be attained with the assistance of modern tunnelling methods, machinery and proper organization.

In the Jura Mountains no fewer than five tunnels, from 2 to 5 miles in length, have recently been driven. The Pyrenees, the natural barrier between France and Spain, have likewise been pierced by several long tunnels, and the Caucasus Mountains are to be tunnelled by a bore not less than 16.25 miles long.

In this country several large projects are now being elaborated and it is but a question of a few years before the Rockies and other ranges will be pierced by long and deeply overlaid tunnels, serving the purpose of eliminating heavy grades, sharp curvature, and the necessity of reaching high altitudes under most adverse conditions.

Size and Number of Bores

Probably the most difficult task that confronts the engineer in tunnelling is the selection of the method that will insure absolute success. Certain features having relatively little weight in connection with the projecting of short tunnels assume enormous proportions when brought into relation with long tunnels—for instance, the choice between single and double-track tunnels. All things being equal, conditions of traffic and safety usually dictate whether a short tunnel is to accommodate one or several tracks. This feature, however, ranks only second when a long and deep tunnel is involved. In such a case there are factors of greater importance—ventilation during and after construction, handling underground water, high rock temperature and enormous ground pressure. All these introduce conditions which require due consideration at the very outset.

The St. Gothard (49,147 ft. long), Arlberg (33,600 ft.) and Loetschberg (47,680 ft.), three double-track tunnels, were pierced under the usual conditions met with in driving deep tunnels. There were no uncommon difficulties as far as rock temperature, ground pressure and underground water were concerned, and this accounts for their successful completion.

It may be useless to point out that at the time it would have been impossible to drive the Simplon tunnel by a single bore of the size usually accommodating a single railroad track, and it is questionable, on account of the conditions encountered, whether a double-track tunnel could have been economically and successfully driven. In 1891, when due consideration was given the Simplon project, the idea of driving two parallel bores was brought up, in order to provide adequate ventilation during and after construction.

Since the completion of the first bore of this tunnel several authorities on the subject have expressed ideas and opinions as to proposed tunnelling methods, which will here be briefly reviewed. For double-track tunnels

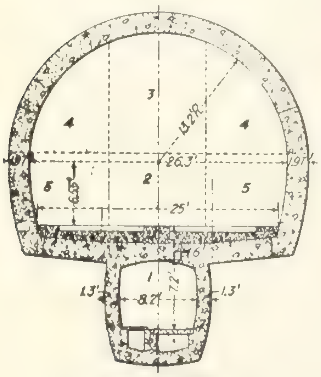


Fig. 1. Henning's Proposed Double Track Tunnel Section

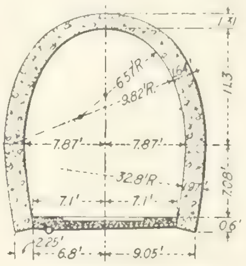


Fig. 3. Weissenstein Tunnel

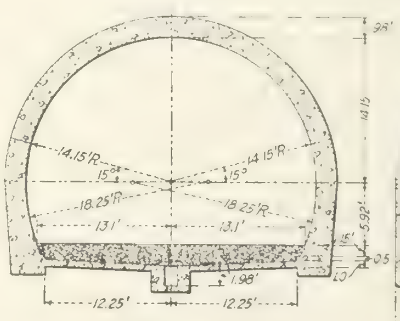


Fig. 8. Mont d'Or Tunnel

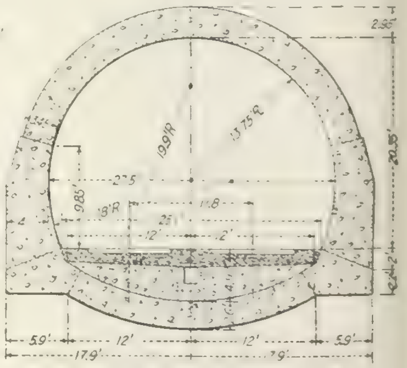


Fig. 10. Heavy Section, Hauenstein Tunnel

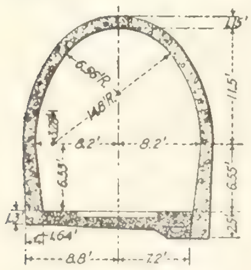


Fig. 2. Simplon Tunnel

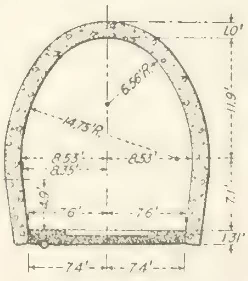


Fig. 4. Ricken Tunnel

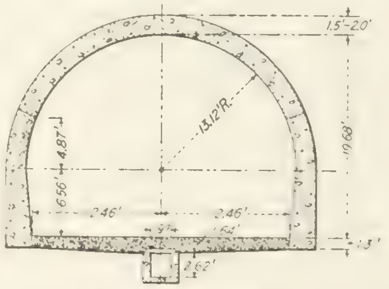


Fig. 9. Loetschberg Tunnel

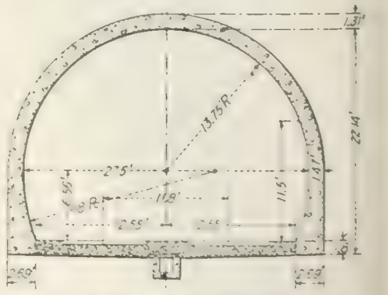


Fig. 11. Standard Section Hauenstein Tunnel

Cross-sections of some of the well-known European tunnels for single and double-track traffic.

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* By E. Luchli, Civil and Hydraulic Engineer, New York, in the Engineering Record.

Table 1—Cost of Tunnel per Lineal Foot, Without Installations

Length of tunnel, miles	$100	$102.5	$105	$108	$110.5	$113.5
1. Single-track tunnel 1, with invert	6.25	7.5	8.75	10	11.25	12.5
2. Parallel heading, partly lined	27	28.5	29	29.5	30.5	31.5
3. Transverse galleries, 1640 ft.	3	3	3	3	3	3
4. Total cost, first construction period	130	134	137	140.5	144	148
5. Completion of tunnel 2	78	80	82	85	87	89
6. Cost of tunnels 1 and 2	208	214	219	225.5	231	237
7. Cost of double-track tunnel with bottom heading	176.5	181.5	186.5	191.5	196	201
8. Increase in cost, 6 over 7	18	18	18	17.5	17.5	17.5

Total Cost of Tunnels, in Million Dollars, Without Installations

Length of tunnel, miles	6.25	7.5	8.75	10	11.25	12.5
1. Tunnel 1 and heading 2	4.27	5.27	6.32	7.38	8.5	9.73
2. Completion of tunnel 2	2.56	3.15	3.78	4.43	5.1	5.82
3. Total cost, tunnels 1 and 2	6.83	8.42	10.10	11.81	13.5	15.5
4. Double track tunnel with bottom heading	5.8	7.15	8.55	10.05	11.6	13.2
5. Difference in cost, 3 over 4	1.03	1.27	1.55	1.76	2.0	2.3

Professor Hennings suggests the method illustrated in Fig. 1, consisting of a tunnel section accommodating two tracks and of a bottom heading located below the main tunnel. The sequence of excavation is illustrated by numerals. The bottom heading is excavated first, and in advance of the other work; the top heading is then excavated by stoping, and the enlargement follows in successive steps. The saving effected over the cost of twin single-track tunnels of the Simplon type, Fig. 2, is claimed by Professor Hennings to be as given in Table I.

Twin tunnels would be driven on the assumption that one bore is completed first, together with a parallel heading, and that the second bore will be completed at a later date, when the traffic conditions increase so as to require the use of two tracks.

Lack of space does not permit showing in detail how the figures above were obtained. At first glance the proposition of Professor Hennings appears to be very attractive, but a chorus of opposing voices arose against this method, and Carl Brandau, a member of the contracting firm driving the Simplon tunnel, and well known for his connection with such undertakings, expressed his views as follows:

Carl Brandau's Views

1. A double-track tunnel does not offer for maintenance and traffic the same advantages as twin-single track tunnels do. 2. Superimposed headings are not as advantageous as two parallel headings during construction, as trains cannot be shifted from one heading to the other, and there is less room for materials, due to the absence of transverse galleries connecting the parallel headings. 3. It is absolutely necessary to line with masonry the roof of the bottom heading, and in most cases, also, the sides and invert, and these features involve costly and complicated constructions in pressure zones. 4. After the completion of the tunnel the bottom heading becomes practically useless, and yet is subjected to continual maintenance. 5. In general it can be safely stated that the saving of 18 per cent. over the cost of twin tunnels is but apparent, for as soon as the means of transportation during construction are no longer guaranteed, the very best driving methods become valueless.

A. Thommen proposes to drive double-track tunnels with the use of a parallel heading located about 65 to 100 ft. from the main heading, and connecting with it by transverse galleries; the main heading would then be enlarged to a double-track tunnel section. This method would, of course, be practicable, but costly, as the auxiliary heading, together with the connecting galleries, would become practically worthless after the completion of the main bore.

The method used in connection with the Loetschberg tunnel, the tile partition built from floor to roof of the tunnel for ventilation purposes has proved adequate and undoubtedly will do for tunnels up to 50,000 ft. long when the overlying depth is not excessive. Where high-rock temperature is to be expected, however, and where 1,000 cu. ft. of air per second are required for ventilation, together with a refrigerating system, lack of space would exclude the use of this method.

Thus it becomes evident that the size and number of bores to be adopted are by far one of the most important problems to deal with, as a change of method would be very costly, if not prohibitive with work under way.

There are no iron rules to guide the tunnel driver in the selection of methods best adapted to the excavation of long and deep tunnels. The capital invested in such undertakings requires the use of methods that will insure rapid and continuous progress, together with unquestionable security for the successful completion of the tunnel, regardless of whatever difficulties may be encountered.

After the somewhat costly experience gained in driving the Mont Cenis and St. Gothard tunnels with the top-heading system and side-drift method, more attention was paid to the use of bottom headings when the 33,600-ft. Arlberg tunnel was started in 1880. The unquestionable advantages gained by this method gave light to a new era in tunnelling, and since the completion of this tunnel the following bores have been or are being driven by the bottom-heading system: Simplon, 65,042 ft. long; Loetschberg, 47,680 ft.; Ricken, 28,200 ft.; Granges, 28,093 ft.; Arthur Pass, 28,060 ft.; Tauern, 28,040 ft.; Hauenstein, 26,683 ft.; Karawanken, 26,161 ft.; Wockein, 20,781 ft.; Mont d'Or, 20,021 ft.; Weissenstein, 12,136 ft.; and Wasserfluh, 11,666 ft.

When applied to the driving of long tunnels the bottom heading, besides enabling some 50 to 65 per cent. of the tunnel section to be stoped down into the bottom heading, serves the purpose of pilot and warns the tunnel driver against impending danger. It also verifies the predictions made by the geologist, if any have been made.

In order to obtain rapid and continuous progress it is of the utmost necessity to spread the field of operation over as large a zone as possible, so as to eliminate, as far as practiable, all chance of interruption. As only one point can be attacked in the heading at any one time, the heading is given such dimensions as will provide plenty of room for the mining operations to proceed advantageously, even under the most adverse conditions, and while its size should be reduced to a minimum, care is to be exercised that ample trackage facilities are provided and that the sectional area of the heading will be such as not to cause the air required for effective ventilation to acquire too high a velocity.

Experience has proved that under normal conditions a heading 7 ft. high and 10 ft. wide can be driven, with the assistance of power drills, at a continuous rate of progress of 20 ft. and over, and that without any special devices the enlargement and lining can be made to follow the heading progress, provided the field of operation is spread so as to minimize contingencies arising from unforeseen causes.

Here, also, features which in connection with short tunnels may rank second prove to be of vital importance in long tunnels. On the one hand the bottom heading carried far in advance of the other work, together with the enlargement spread over a large zone, minimizes delays caused by unfavorable ground conditions, inrush of water, etc. On the other hand, the organization of the working forces, together with the schedule of operations, becomes an important factor. For instance, a misunderstanding on the part of one of the mining crews, or a train hopelessly stalled between the portal and the first working point, would cause considerable havoc in all driving operations, and it is here that only the slow and sound evolution of progress can overcome difficulties that man's brains and will power can not master in a day.

Ventilation

A great gap has been filled in the field of ventilation since the driving of the Mont Cenis tunnel, where the only air available was obtained from the exhaust of the rock drills. The miners' anemia was high and the driving progress very slow. As a matter of fact, it would have been impossible to consume much explosive or to have many shifts working in the tunnel at the same time.

The same conditions prevailed when driving the St. Gothard tunnel, where only 70 sec.-ft. of air were made available for ventilating purposes. The miners' anemia was intense; on the south side of the tunnel as many as 60 per cent. of the men were more or less affected. During bad periods men would quit work after two months, although working only two out of three days, with five working hours only per day.

The poor ventilation, combined with the relatively high rock temperature, and the rudimentary sanitary conditions were a great hindrance to progress, and it is stated, for instance, that the contractors lost as many as 20 horses per month.

The sanitary conditions at the Arlberg tunnel, together with the introduction of a ventilating system capable of delivering from 100 to 200 cu. ft. of air per second, were a great help toward good progress. It is true that the overlying mass was small, thus causing the maximum rock temperature not to exceed 65 deg. Fahr., but the use of Brand water drills made it impossible to use the exhaust for ventilation.

Cooling Air

When in 1891 the Simplon project was taken up the maximum rock temperature expected to be encountered was 108 deg. Fahr. A very substantial system of ventilation was recommended by the commission of engineers charged to report on the feasibility of this project, and after the impracticability of using ventilating pipes for such an undertaking had been demonstrated theoretically, twin tunnels were recommended. The consistency of the results of this computation with practice was only too well proved when, during the driving period of this tunnel, the rock temperature rose up to 132 deg. Fahr. and necessitated an elaborate refrigerating system in addition to the ventilating plant of some 1,200 sec.-ft. capacity.

One cannot realize the meaning of an accidental shutdown of the ventilating plant in an undertaking of this kind. Imagine hundreds of men working some 30,000 ft. away from the portal, in an atmosphere saturated with humidity, vitiated by gases due to the consumption of hundreds of pounds of explosives, and in a temperature of 130 deg. Fahr.

The limit of efficiency of cooling the air in a deep

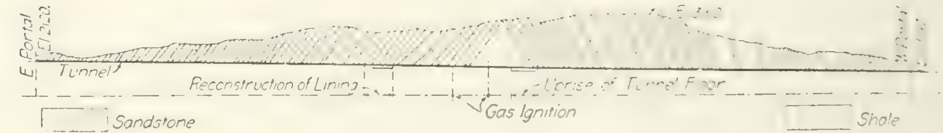

Fig. 5. Ricken Tunnel. 28200 Feet Long

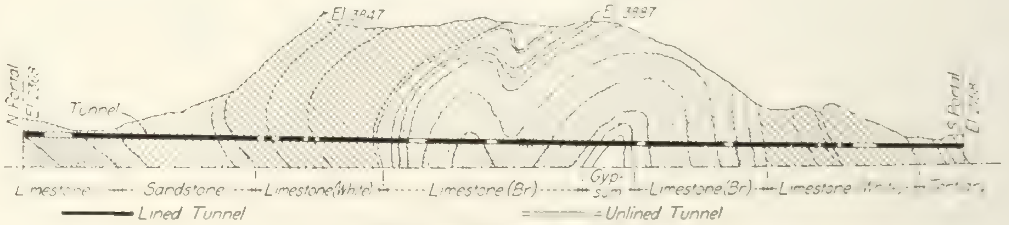

Fig. 6. Weissenstein Tunnel. 12136 Feet Long

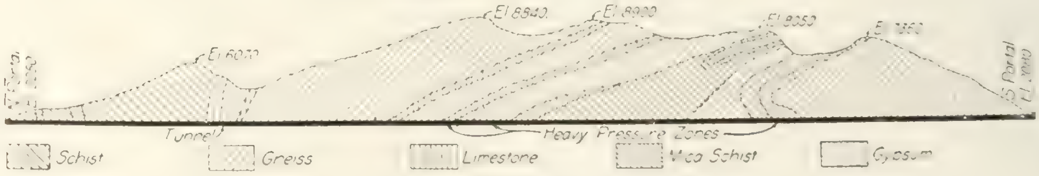

Fig. 7. Simplon Tunnel. 65042 Feet Long

Profiles on lines of Ricken, Weissenstein and Simplon tunnels.

Table 2—Ventilation Statistics for Six Long and Deep Tunnels

Name of tunnel	Simplon	St. Gothard	Loetschberg	Mt.Cenis	Arlberg	Ricken
Tunnel length, ft.	65,042	49,147	47,68$	42,145	33,600	28,200
Maximum elevation of range penetrated, ft.	9,320	9,380	9,650	9,675	6,660	3,620
Maximum overlying depth, ft.	7,000	5,570	5,550	5,430	2,360	1,740
Maximum rock temperature, deg. Fahr.	130	88	94	85	65	74
Approximate number of men in tunnel	800	400	600	250	700	140
Explosives used per 24 hr., lb.	1,100	660	900	440	770	500
Ventilating air, per sec. ft.	1,270	70	300-350	18-35	100-200	110-140

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tunnel by introducing air from outside is rapidly reacher, especially during the summer months. In the Simplon tunnel this limit was reached when the rock temperature was about 100 deg. Fahr. It was then found necessary to use auxiliary methods, either to avoid heating the air used for ventilation or to cool it after heating. It is preferable to keep the air for ventilation at as low a temperature as possible, either by insulating the air-conveying pipes, if any, or by insulating the walls of the heading or tunnel with a thin coat of cold water by means of pulverizators or jets. Both systems are costly, especially the second one, unless cold water is available under natural pressure.

The problem of ventilating deep tunnels during and after construction has become a complicated one, requiring in itself the constant attention of an engineering staff and laboring force especially assigned to this work. The following figures published by Dr. Pommetti for the Simplon tunnel, north side, give only a small idea of the advantages gained by an efficient ventilating and refrigerating system: Out of a total of 3,445,754 man-shifts only 52,677 or 1.53 per cent., represented sickness. There were 37 deaths caused by illness and 10 by accident.

Table 2 gives the amount of air provided for ventilation during the driving of six long and deeply overlaid tunnels.

Ground Pressure and Tunnel Lining

The subject of ground pressure and tunnel lining has caused much ink to flow during the last thirty years, and yet after numerous observations made in mines, shafts, tunnels of all kinds, as well as in laboratories, no conclusion has yet been reached that has stood unquestioned for any great length of time.

This chief difficulty in designing tunnel linings lies in the lack of knowledge as to the intensity and direction of the rock pressure to be guarded against. In almost every tunnel geological formations and stratifications vary. Even after exhaustive studies of the geological formation of a range have been made uncertainty exists as to the behavior of the materials to be penetrated. Numerous are the failures of tunnel lining, either due to excessive and unequally distributed pressure or to lack of care in designing tunnel linings.

The opinions of geologists and engineers as to rock pressure in tunnel construction vary greatly. Culmann's theory is based on the supposition that pressure on tunnel linings is greatest at the roof of the tunnel and that the intensity of pressure depends on the overlying depth and cohesion of the rock.

Ritter's theory is opposed to that of Culmann. His pretension is that the pressure on the roof of a tunnel does not depend on the overlying depth but is equal to the weight of a body of material having the form of a semi-parabola, less the stress required to cause rupture by tension along the semi-perimeter of the parabola. The intensity of the pressure would then be independent of the depth overlying the tunnel, but would vary according to the width of the excavation.

Heim's studies are perhaps more elaborate and cover a broader field than any others ever made on this subject. His theory, however, met with little enthusiasm, especially on the part of tunnel drivers, who will not accept the theory that the ground pressure on the roof, sidewalls and invert acts as hydrostatic pressures do on a submerged body, yet with the difference that the ground pressure acts more or less slowly, on account of the variation in cohesion and friction of the materials caused by the unequal geological formation of mountain ranges. According to his theory the lining of the St. Gothard, with 5,000 feet of overlying depth, would require a lining having a thickness of 20 feet, a supposition which, of course, would make the driving of deep tunnels prohibitive.

However, Heim's conception of ground pressure is far from being erroneous. Observations made in the unlined parallel heading, as well as in some of the transverse galleries of the Simplon tunnel, indicate that several years after construction excessive pressure caused the side walls, invert and roof to crush, thus practically filling certain sections of the bores. It has also been observed that the intensity of the shelling of the rock often increased with the overlying depth. For instance, vertically stratified gneiss, with 2,300 ft. of burden, would not show any sign of disturbance, yet shelling of the same rock would take place with 4,000 ft. of overlying depth.

Shelling took place also in the Leggistein tunnel several years after its completion, and similar signs have been recorded on the roof, side walls and invert of tunnels driven through apparently solid rock, usually not affected by weathering, gases and heat. It is, therefore, possible that in certain instances the overlying depth may cause serious disturbances in a tunnel after, if not during, construction.

The contractors of the Ricken tunnel (Figs. 4 and 5), driven chiefly through shale and sandstone, met with much difficulty during construction. The ignition of coal gas was a serious hindrance to progress, and soon after completion serious movements occurred in several sections of the side walls, in some instances decreasing the width of the tunnel by 1 to 1½ ft. and necessitating the complete reconstruction of the masonry. In another instance the concrete invert was raised, yielding under the rock pressure. It had to be replaced by stone masonry over a length of 470 feet. The cost of repairs to the masonry, supplementary drainage system, interest charges increased by delays, etc., amounted to approximately $194,000, and the opening of the tunnel to traffic was retarded fully two years.

The Weissenstein tunnel (Figs. 3 and 4), driven through limestone and sandstone, was lined more than 87 per cent. of its length. Movements of the side walls, varying from 1 to 3 in., took place soon after construction and continued during three years.

The difficulties due to rock pressure encountered in driving the Simplon tunnel (Figs. 2 and 7) hardly compare with those met in the driving of the tunnels above referred to. At a distance of 14,600 feet from the south portal, with some 4,000 feet of overlying gneiss having a shistose appearance, the ground pressure necessitated masonry lining 5.5 ft. thick over a length of 138 feet, at a cost of $1,520 per lineal foot of tunnel. The driving of this tunnel was constructed on a lump-sum basis.

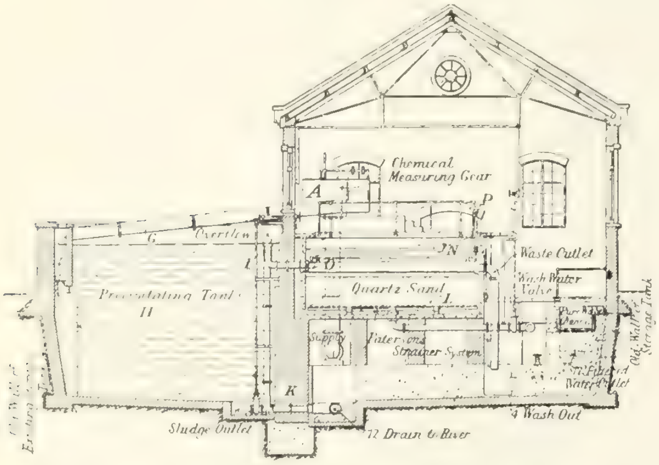
Figs. 8, 9, 10 and 11 give sections of some of the other tunnels to whihc reference has been made.

The foregoing facts demonstrate clearly the enormous risks incurred by contractors bidding a lump sum on long and deeply overlaid tunnels and the necessity of making elaborate and thorough studies of the problem involved in undertakings of this character.

A Rapid Filtration System

The Paterson Plant at the Cheltenham Water Works, England

It is recognized that filtration through slow sand-beds of sound construction, operated under efficient supervision, secures a degree of purification leaving little to be desired beyond the elimination of the disadvantages inherent in this system—namely, the inability to remove discolorations due to fire-clay, peat stains, and other causes. These cannot be removed on a large commercial scale without chemical treatment, and water so treated must not be passed directly on to slow sand-beds owing to the rapidity of choking up, which necessitate repeated paring of the surface film and washing. The principal screen for the interception of suspended matter and bacteria in the slow sand filter is this surface film, consisting of algoid and other vegetable growths, and requiring considerable time to form. In order to maintain the required output it is necessary to duplicate installations of moderate size, so that the cleaning may be effected without hastening the rate of filtration in the active beds; but this entails a large capital outlay and considerable waste of water for sand-washing and film formation. With the rapid filtration system these washing and filtering processes occupy only a few minutes, and by the Paterson method of compressed-air cleaning the amount of wash-water required is reduced to a minimum, as the water is not used during the agitating process, but only to wash the loosened impurities to the drain.



The Paterson rapid filtration plant of the Cheltenham water works.

The Paterson system claims to effect in a convenient manner the complete elimination of all discoloration, the neutralization of natural acidity, and the removal of suspended matter and harmful bacteria.

In standard practice the Paterson system differs essentially from the ordinary mechanical filter in so far as (a) the gravity system is adopted; (b) the filtering surface is not broken up by mechanical agitators; (c) two or three hours are allowed for the reaction to complete before the water passes on to the filters; (d) the rate of filtration area is more than double the recognized standard of existing rapid filters. The process, moreover, is carried out in three distinct stages—namely (1) the accurate measuring of the water and the addition and mixing of the coagulant (and, where necessary, sterilizing reagent) in precise ratio to the amount of water passing; (2) the subsidence of the treated water in a reaction and precipitating tank of sufficient capacity to allow the completion of the chemical reaction and the precipitation of the grosser impurities; (3) the final purification by rapid filtration through quartz sand.

At the Cheltenham plant the water, pumped from the River Severn, enters an automatic measuring and chemical supply tank, and discharges through two V notches, which accurately gauge the quantity of water passing. A float, riding on the surface of the water, controls the position of two tapered valves which supply the reagents in the precise ratio to the quantity of water delivered. The reagents (sulphate of alumina for the coagulation of the impurities and extraction of the coloring matter, and hypochlorite of lime for sterilization when required) are maintained at a constant head above the valves by ball-cocks connected, by pipes, to the pressure storage tanks in the basement. The contents of the chemical tanks are continually agitated by compressed air, which serves also to lift the reagents to the controlling apparatus. The chemical solutions are prepared in concrete tanks on the filter-house floor-level, the necessary agitation being furnished by compressed air.

As the water passes from the tank A, Fig. 1, it comes in contact with the reagents, with which it is thoroughly mixed as it passes down the mixing-trough G, which discharges into a reaction and precipitating tank H, having a capacity equal to about three hours' pumping, allowing time for the complete reaction of the alumina, and the precipitation of the grosser impurities. The partially purified water overflows through bell-mouthed draw-off pipes I into six Paterson rapid gravity filters. These filter-tanks are made of reinforced concrete, and contain 36 inches of special grade quartz-sand filtering medium resting on a stratum of pea-gravel. In each of these filters there is a centrally placed inlet distributing and a waste draw-off channel K. The filtered water is collected from underneath the gravel by the system of gun-metal strainers shown at L. These have screwed caps and renewable phosphor-bronze screens, and they discharge through the automatic outlet controller into the inspection box, from which the water passes into the clear-water channel. All the valves and fittings are so arranged that the entire filtering and washing operations are controlled by one attendant from the main gallery.

In the cleansing process the filter-beds are first agitated with sterilized compressed air, at a pressure of about five pounds per square inch, and the impurities, loosened by this air scouring operation, float to the waste outlet by a reverse current of wash water. The process is particularly efficient, and the filter unit may be thoroughly cleaned and restarted within ten minutes.

After cleansing, and while the surface film is forming, the automatic control prevents the filter from coming into full operation for ten or fifteen minutes. This controller fulfils a very important duty. It is in the form of an equilibrium valve under double control, and acts in the following way: When the cleansing process has been completed, the water above the filter-bed is, of course, at the level of the waste-trough, and the outlet valve is held down in its closed position by the weight of the float N, in the figure. When the filtration process recommences, however, the inlet valve O is opened by means of the hand-wheel P, and the filter gradually fills up, but the outlet controller remains closed until the water level reaches the float. The outlet valve gradually opens as the float rises until it is released from the restraint of the float, and the rate of discharge is then controlled only by the regulating float in the inspection box. This inspection box is fitted with a V-shaped overflow weir, the arrangement being such that when the water, before flowing through the weir, rises to the height determined by the maximum allowable rate of discharge, the regulating float partially closes the outlet valve so that this maximum rate of filtration cannot be exceeded. By means of the outlet controller the following conditions, on which successful filtration depends, are secured: (1) It allows time for filling, and then starts the filter gradually, after the cleansing process is complete, so insuring that all water entering the service main is of the required degree of purity. (2) It governs the rate of overflow, so that the maximum safe rate cannot be exceeded. (3) It steadies the flow and insures a uniform rate of filtration. (4) It prevents furrowing of the filtration surface by insuring that a protective layer of water is always maintained above the sand-bed when the supply, for any reason, is very much below the normal or temporarily closed.

The advantages claimed for this system may be summarized as follows: (1) The central channel insures the equal distribution of the incoming water, prevents furrowing, and draws off the impurities uniformly during the cleansing process. (2) The compressed-air and wash-water agitation thoroughly scours the sand grains, and keeps the bed fresh and wholesome by repeated aerations. (3) The lowest possible proportion of wash-water is required, averaging 1 or 2 per cent. of the total volume purified. This result is due to the fact that the wash-water is not required during the air-scouring process, but only afterwards, to float the loosened impurities to the drain. (4) The liberal filtering area provided (more than double the recognized standard for existing rapid filters) enables the rate of filtration to be kept at a low figure. (5) The filters are simple, compact, and all valves are operated from the main working platform.

A record in output has been established, it is claimed, by the travelling plant which is making the concrete blocks for facing the Kensico Dam of the Catskill Aqueduct at Valhalla, N.Y. The concreting tower is carried on railroad trucks, is equipped with three Ransome mixers, as described in the Engineering Record of May 10, page 528, and traverses three rows of Blaw-steel forms in which 4200 blocks per month are cast, equivalent to about 5000 yd. of concrete. The concrete is delivered from the mixers directly into the forms. No buckets or derricks are employed. A large number of blocks have already been manufactured and are piled up, many tiers high, adjacent to the casting yard to season before being placed in the structure. An important advantage of the plant is said to be the elimination of concrete buckets and the direct delivery of the concrete.

Life of Water Pipe in Vancouver

A 16-in. riveted steel water-supply main was recently uncovered in Vancouver, B.C., where it had been in use for more than twenty-two years. On making a careful examination of this pipe it was found to be in a good state of preservation, the only pitting observed being at a few of the field connections where the paint had been scraped off in order to make the lead joints and, through careless workmanship, had not been repainted. Judging from its present condition, this pipe will probably last as long again, according to Mr. H. M. Burwell, consulting waterworks engineer, so that its total life should not be under forty-five years. It has a shell of only ⅛ in. in thickness, and is coated with an asphaltum compound by dipping the pipe into a bath raised to a temperature of about 350 deg. Fahr. Since the year 1905 the minimum thickness recommended for the shell of steel pipes used in the city system is 3-16 in. With good coating and proper care in laying the pipes they are expected to last for fifty years in ground of this nature.

When conditions are such as exist in the Vancouver supply mains, where the entire length of the pipe is constantly full of water under pressure so that the wood is kept saturated, a continuous wooden stave pipe should have a life equal to that of the steel bands, Mr. Burwell states. This, however, only applies to pipe made of carefully selected, sound fir which is free from sapwood. Where the bands have a diameter of not less than half an inch and are properly coated with paint, they are expected to last as long as the steel pipe.

The life of the flexible cast-iron submerged mains under the Narrows of Burrard Inlet has been watched with considerable interest by waterworks officials. These mains are subject to continual tidal currents which attain a velocity up to 6 and 8 knots per hour. The wear on the pipes at the First Narrows is thought to be greatly increased by reason of the fact that Capilano Creek empties quantities of gravel and sand into the tidewaters near the pipes, so that the corrosive action of the water is accelerated by the wear of the sediment carried backward and forward over the pipes by the currents. Under these conditions the life of the 12-in. submerged mains, having a thickness of 1 in., has been found to be about fifteen years.

During the last twenty-five years four old submerged mains have been hauled out and replaced. In this period there have been numerous repairs and about twelve bad breaks, which were repaired under water by divers. The breaks were caused chiefly by ships' keels which landed on the pipes near the shore ends during foggy weather or when vessels were beyond control.—Engineering Record.

Method of Estimating Structural Steel[*]

Taking Off Quantities and Summarizing—Figuring the Weight of Columns—Riveted Work and Other Costs

One of the leading books upon estimating says of structural steel, "First find the correct weight of steel and then multiply by the proper price per pound." The fact that the correct weight must be ascertained and then the proper price, or rather combination of prices chosen, makes the estimating of structural steel one of the most detailed processes that the building estimator is called upon to undertake.

As in estimating other branches of work in a building, first the quantities must be "taken off," then summarized by grouping together all tonnage that has the same kind of shop work.

The cost of the work is generally made up as follows: (1) The cost of the fabricated material F.O.B. cars point of delivery. (2) The cost of unloading and teaming to the building. (3) The cost of erection and field painting.

In taking off quantities from the plans, each beam, or each group of beams which are alike, is noted with the number of beams, size, weight per foot, the kind of shop work to be performed, the number of end connections, recording by distinct abbreviations, whether such connections are to another beam or girder, or to a column, bearing plates and anchors if any. The usual classification for beams is as follows:

Plain—Cut the length with a variation of not over ⅜ in. from ordered length.

Single Punched—Punched one size hole in either web and flange.

Double Punched—Punched one size hole in both web and flange.

Framed—Having connection angles at one or both ends rivetted or bolted to connect with some other member, and with one or both ends, if required by the framing, coped to engage the flange of a supporting beam or beams made into a single member by the use of bolts and separators.

Rivetted—Having plates, or angles, of shorter lengths, or running the entire length of the beam, rivetted to the flange or flanges, or to the web of the beam.

Fittings—Connection angles, bolts and separators. In dealing with rivetted beams, the estimator has the option of treating the beam together with the plates or angles rivetted to it as a rivetted beam, or to regard the beam alone as a single punched, double punched or framed, and classify the plates, or angles, as fittings, choosing whichever method gives the cheaper cost.

Tie rods, bearing plates and anchors, are generally figured by themselves and not classified as fittings.

The length of beam is taken center to center of girders, or face to face of columns, and the steel estimator's sheet appears somewhat like this:

(1)	2,	15 x 42	D P 2C	16-8
(2)	4,	12 x 315	F^1 1C	14-1
(3)	1,	12 x 40	S P 1a 1b 1c	14-1
(4)	2,	8 x 18	B & S 2b	12-0
(5)	1,	15 x 60	riv. 2C	18-2
	1,	12 x ⅜ pl		

Item (1) signifies 2, 15-in. x 42-lb. beams, each 16-ft. 8-ins. long, double punched and connecting to columns at both ends.

Item (2), 4, 12-in. x 31½-lb. beams, each 14-ft. 1-in. long, each having standard connection angles at one end, and connecting to a column at the other end.

Item (3), 1, 12-in. x 40-lb. beam, 14-ft. 1-in. long, single punched, connecting to a column at one end, and with a bearing plate and anchor at the other.

Item (4), 2, 8-in. x 18-lb. beams, bolted together and with bearing plates at both ends.

Item (5), a 15-in. x 60-lb. beam, 18-ft. 2-ins. long, with a 12-ft. x ⅜-in. plate rivetted upon one flange, connected to columns at each end.

Connection angles are figured separately from the beams, the weight of a pair of standard connection angles with the rivets required being taken from the Carnegie or Cambria steel hand book.

In computing the weight of connection angles, the beam sheets are run over and all connections of the same weight are grouped together. With rivetted beams, the weight of beam with all plates, angles and rivets, except connection angles, are taken together.

Often in a steel frame, the outside members consist of two channels, or an I-beam and channel, with an angle rivetted to the channel. Such a member is generally split up and the I-beam or one of the channels is considered bolted and separated, while the remaining channel with its angle is considered as rivetted.

The usual shop prices for beam work per 100 lbs. is as follows:

Cutting to length + ⅜-in.	no charge
Single punched	15 cts.
Double punched	25 cts.
Framed	35 cts.
Bolted and separated	35 cts.
Riveted	50 cts.

Beams over 15 inches in depth cost 10 cents per 100 lbs. extra.

In summarizing the weight of beams for shopwork, this is most easily taken care of by including the deeper beams in a classification one step ahead; thus, a single punched 18-in. beam would be included with double punched beams 15 inches and under.

There is a further charge of, generally, 5 cents per 100 lbs. for painting, and sometimes a charge of 5 or 10 cents per 100 lbs. for drawings. The steel contractor may be called upon by the specifications to pay a charge of 75 cents to $1.25 per ton for inspection.

Fittings are generally figured at $1.55 per 100 lbs. for shopwork. Tie rods at the price of the roads and nuts plus freight, plus 50 cents per 100 lbs. for shopwork. Bearing plates, allow about 15 cents per 100 lbs. for cutting from the long plate. Anchors, generally a small item, figure at 3 lbs. each, and 4 cents per pound.

Sometimes beams are framed into another beam on an angle or skew, at one or both ends. In this case, the beam is classified as framed, but the connections, which must be heated and bent, are classified as bent connections, and priced at a higher rate than ordinary fittings, say 6 cents per pound for material and shopwork.

To the base price of the beams at the mill should be added the cost of shopwork, and these different costs multiplied by the tonnage of each sort of work.

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[*] By Geo. A. Merrill, Amesbury, Mass., in Engineering and Contracting.

The items of freight, paint, drawings and inspection are more easily figured from the total weights of steel.

In building work, rivetted work generally includes the following: (1) Columns, (2) Beam Girders, (3) Plate Girders, (4) Trusses.

Columns may be I-beams, Bethlehem H-sections, latticed channels, latticed angles, plates and angles, with or without flange plates, and plates and channels. The Z-bar column, once a favorite, is now rarely used. In figuring the weight of columns, the size, weight per foot, and length of the principal members are taken off, and the weight of the column shafts computed. To the weight of the column shafts must be added:

(1) Weight of hitch angles at bottom, and steel base plate if one is used.

(2) Weight of splice plates.

(3) Weight of connections of beams to columns. The beam sheets are run over, and the number of connections noted and computed, keeping connections of the same weight together. The weights of such connections are given in some of the steel hand books. Often they may be computed from a typical column detail furnished with the framing plans.

(4) Weight of rivets: In plates and angles, and plates and channel columns, rivets will run from 6 per cent. to 5 per cent. of the weight of shafts with fittings, being less with heavy shafts. With I-beams or Bethlehem H-sections, the rivets must be estimated with each plate or angle attached, calling each rivet (say) ½ lb.

In latticed angle columns allow 40 per cent. of the weight of main members; for lattice bars and rivets, and for latticed channels, 60 per cent.

Beam Girders. Take the weight of beams with cover plates and allow 2 lbs. to 3 lbs. per foot for rivets.

Plate Girders. If stiffeners and fillers are taken off, add 5 per cent. to 6 per cent. for rivets, according to whether the girder is light or heavy. If only the main members of the girder are taken off, add 15 per cent.

Trusses. Take off the sizes and lengths, center to center, of joints and add 30 per cent. for light trusses made up of 2½ x 2-in. angles, and 25 per cent. for trusses having chords of 4 x 3-in. angles, or more.

For the small work usually included with the structural steel in building work, such as framing for pent houses, skylight curbs, bulkheads, cornice brackets, take the weight of the main members and add 25 per cent. Price at 3 or 4 cents per pound for material and shop-work.

It is a general principle in estimating rivetted work, that light work with considerable shop-work must be priced high, and as the work grows heavier, to decrease the pound price.

The prices for rivetted work are not as definite as those for beam work. Fair average prices would be about as follows:

	Cents
Beam girders, per 100 lbs.	60
Plate girders (according as the work is heavy or light)	55 to 80
Columns—	
I-beam columns	50
Plate and angle	65 to 75
Plate and channel	70 to 80
Bethlehem H columns	55 to 65
Latticed Ls	80 to $1.00
Latticed channels	80 to $1.10
Trusses—	
Very light	$1.25
Ordinary	1.00
Heavy	0.85

Cast Bases: Usually columns rest upon cast bases. Sometimes the bases are detailed upon the framing plans, and in such cases the weight can be readily computed, allowing 0.26 lbs. per cubic inch. Often, however, merely the size of the bottom of the base is given, leaving the estimator to arrive at the weight as best he can. It is a good practice to record and preserve the weight of well proportioned cast bases, figured upon previous jobs, to use in cases such as these. The following are average weights for cast bases:

24 x 24	525 lbs.
27 x 27	675 lbs.
30 x 30	850 lbs.
33 x 33	1,050 lbs.
36 x 36	1,275 lbs.
39 x 39	1,500 lbs.
42 x 42	1,750 lbs.
48 x 48	2,300 lbs.

The cost of cast bases varies from 2 to 2¼ cents per pound.

To the cost of the fabricated material delivered upon cars must be added a profit. Just what profit to add depends upon conditions. If all the mills and structural shops are busy they will put on a higher percentage than in dull times.

The mills will generally quote on beam work at the prices previously given, without adding any profit.

The cost of teaming to the site can generally be figured close enough by estimating the weight of an average load, the number of trips per day a two-horse team will make, and the cost per day for such a team. If the pieces are heavy, the time of one or two helpers at the car must be added in.

The erection cost will vary with the character of the work, whether straight or crooked, light beams or heavy, whether the rivets are bunched together at column connections, or well scattered over the work, whether bolted or rivetted connections.

A fair price is $10 per ton, although the figures may get down to $8 or up to $12. If unusually heavy girders or trusses occur in the work, it is best to figure the erection of these separately from the remainder of the steel.

The part of steel-estimating, which is both tedious and time devouring, is computing the weight after the work is "taken off."

The estimator should be an expert with the slide rule and know by heart the unit weights of the usual sizes of plates and angles, and have convention schedules at hand of the weights of beams and column connections, rivets, bolts and separators.

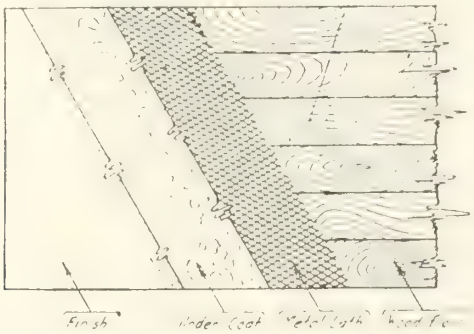
Cinder-concrete wall lining is used on the exterior walls of the new building of the Deutsches Museum, at Munich, Germany. Its purpose is to serve as insulation and also supply a base which will take nailing, etc. It is not made with ordinary ashes or cinders, but with broken tufa, from Andernach-on-the-Rhine. With this material a cement concrete is mixed 1:12 or 1:16, and used to form a 5-in. layer on the inner face of the exterior wall, the rest of the wall being stone concrete. This tufa concrete permits nails to be driven in easily, and it can be worked with tools, as was proven by sawing into it at the corner of a door jamb with an ordinary crosscut saw.

Composition Flooring—Its Field, Qualities and Cost

By H. M. Hooker

THE basic process for composition flooring was worked out, or at least given to the world, in 1866, by Stanislas Sorel of Paris, France, who at that time took out patents for a cementing material composed of magnesia and chloride of magnesium as the two chief ingredients to which other powdered substances could be added. For exterior use, it was discovered that this "Sorel Stone" had not the enduring properties necessary. But chemists, manufacturers and workers, from this basic compound, have developed a permanent floor surface by the addition and treatment of different ingredients. Gradually the substance has been improved until, about seven years ago, a really desirable flooring material was produced.

Composition flooring is a light-weight, fireproof, resilient covering. It is laid plastic, usually about one-half inch thick, and sets in a few hours into a seamless, tough, warm and rather quiet mass; in appearance and feel not unlike high-grade battleship linoleum. Its jointless character and comparative freedom from cracks, due to warping, uneven settlement and vibration of buildings give it special value. It is laid over wood, metal, or concrete, and adheres firmly thereto. It appears in many colors and combinations of color from black to a light pearl-gray.



Typical composition flooring on wood.

In addition to its sanitary qualities, it combines warmth, resilience and a degree of quietness not possessed by concrete, tile, or terrazzo. It was first installed in hospitals, schools and public buildings.

Recently industrial concerns have put it to use in places where many employees are on their feet for hours at a stretch and where heavy or constant trucking has destroyed the more generally used Portland cement concrete surface. In reducing foot-weariness it proves to be about on a par with maple flooring. As a wearing surface under heavy trucking it has a much longer life than cement, wood, or asphalt. Actual wear in runways through which trucks frequently pass and in livery stables where the calks of sharp-shod horses attack the surface returns a verdict distinctly in favor of composition flooring.

It is laid plastic in one or two coats and sets in a monolithic mass. Where base and wainscot are used, these are ordinarily run into the flooring material with a cove, so that the finished work has a smooth, jointless surface which can be freely mopped, scrubbed and cleaned, and which offers no refuge for filth and germs.

A desirable characteristic in flooring is resilience. It is the most pleasing feature under the tread that a floor can possess. For restaurants, offices, factories and places where people are forced to stand for hours at a stretch, it is a cash asset. In this respect composition flooring ranks high. Cork tile, linoleum, rubber tile when new, and white pine possess somewhat more resilience and we owe much of their flooring value to this fact. Yet cork, linoleum and rubber tile are slightly more tiring because, owing to their softness, they offer more frictional resistance to the foot or truck wheel passing above.

Two factors play an important part in determining the waterproof value of a flooring: First—the porous or absorptive character of the material itself; second—the joints or seams which, as usually installed, it offers to the passage of liquids.

Composition flooring is practically non-absorbent, its coefficient of absorption for 48 hours being less than two per cent. During the first few minutes there is a slight absorption (less than one per cent.); thereafter for a few days it very slowly takes up more water.

Under constant immersion there is a gradual softening of the regular commercial composition which disqualifies it for swimming tanks and for conditions of permanent wetness. If the material is intermittently dried there is no deterioration. It may therefore be successfully used for very wet places where the moisture is applied at intervals, as in the case of shower, toilet and bath-rooms. Cork is the warmest flooring material in standard use. Composition comes next, ranking but little lower. It is therefore particularly desirable for bathrooms, bedrooms, refrigerating rooms, schools and other places where it is desirable to retard heat transference,

The life of composition flooring when properly installed is undetermined. Material suitably installed six or eight years ago shows no appreciable deterioration. It will doubtless be good for one hundred years.

This flooring may be heated to a temperature of 1700 degrees Fahrenheit, chilled in water, reheated, chilled and reheated again, and will not be destroyed. It will stand temperatures in excess of those usually found in burning buildings and is much above the fireproof requirements of city building codes and fire insurance companies. Among fireproofed flooring materials it is unique in its possession of softness, warmth and comfort under the foot. It is the highest of the fireproof materials, and withal weighs but slightly more than wood and much less than concrete.

The materials to be used in the case of any high-grade floor are prepared at a factory and delivered to the job in two units,—the magnesium chloride and the dry mixture.

The cost of composition flooring varies with the area to be installed at one time. The larger the installation, the lower the square-foot price. The range is usually between twenty and fifty cents per square foot. When laid in a considerable area, the price is about one-fourth that of marble, one-half that of good tile, and two-thirds that of terrazzo. It is about one and one-half times the price of a wood floor when on a wood foundation. On a concrete foundation the cost of wood and composition flooring is about the same, as the latter can generally be set off against the cost of wood sleepers, cinder concrete fill between sleepers and the hardwood finish. The accompanying table gives approximate comparative prices for composition flooring and some other standard flooring materials during 1912, based on areas of 1,000 and 10,000 square feet.

The foundation for this material may be either wood, concrete, iron, or steel. It cannot be laid directly upon plaster, adamant plaster, plaster board, brick or terra cotta.

It may be laid upon new or old wood floors. The wood flooring should be well seasoned, not over six inches wide and not less than seven-eighths of an inch thick. Where possible, the underflooring should be laid rough side up and in such manner that it will not sag under the load for which the flooring is intended. The best practice is to apply expanded metal lath on all wooden foundations. This metal reinforcement adds only about one and one-half cents per square foot, and its added protection more than offsets the possible saving.

The flooring will usually take its initial set in from four to six hours, but travel should be kept from it for seventy-two hours, although it will stand careful walking in half that time.

With regard to after-care, the flooring may be left permanently untouched. If, however, at intervals of a few months it is gone over with an inexpensive mixture of oil and wax, secured from any flooring manufacturer, its beauty is greatly enhanced and its life prolonged.

Lighting Principles in Mills

The following fundamental principles of cotton-mill lighting have been outlined by Mr. Albert L. Pearson in a paper read before the American Society of Mechanical Engineers: As the operative is the one for whom the light is provided, he should be given every consideration. Adjustable lamps, hung low down, tempt operatives to meddle with them. Lamps should be arranged to give uniform illumination at the working plane, avoiding shadows, as far as possible, and particular attention should be given to the requirements of each machine. White walls and ceilings add to the effectiveness of the lighting system. With individual driving of machines it is possible, owing to omission of overhead belts and shafting, to keep the rooms cleaner than with mechanical or group driving, thus benefiting the lighting system. On account of glare, low exposed units should be avoided. In places where it is necessary to have the lamps low down, reflectors which will entirely conceal the filament of the lamp should be used. The position of lamps should be carefully determined, both as to spacing and mounting height. In general, the height of the lamp above the floor should be such that with the spacing available the lines representing the angles of maximum illumination with a given type of reflector will cross at the working place.

It is anticipated that during the next few years the government will spend one hundred million dollars on new docks and harbor improvements. These contemplated works include dry docks at Victoria, Vancouver and Esquimalt, and terminal and harbor improvements at Montreal, Toronto, St. John, Hamilton, Halifax, Fort William and Sault Ste. Marie.

Windsor Station Extension, Montreal

THE extension of the Windsor Station, C. P. R., Montreal, is now practically finished. The extension gives a total frontage of 490 feet on Windsor street and a frontage on St. Antoine street of over 170 feet. The foundations are carried to rock by means of cylindrical caissons. There is a difference in levels of about forty feet between one end of the extension and the old building, and this enabled large vaults to be constructed beneath the main floor and beneath the tracks. These vaults cover a ground area of 66,000 sq. feet, leaving room for an Immigration Hall covering 10,000 sq. feet, Chinese waiting room covering 6,900 sq. feet and third class passenger waiting room covering 3,000 sq. feet.

The cubic capacity of the new portion of the building, exclusive of vaults under tracks, but including the concourse is 4,703,000 cubic feet, while the viaducts total another 1,000,000 cubic feet, and the power houses or 16 including the basement, and is 225 feet above the level of St. Antoine street. It contains water tanks with a combined capacity of 30,000 gallons. The general waiting room in the main building, has a ground area of 7,800 ft. The new building alone contains 2,800 tons of steel, apart from the steel used in the train sheds.

When completed there will be thirteen elevators, eight for passengers (two of which have a lifting capacity each of 7,000 pounds) four for freight and baggage, and one for the kitchen and restaurant.

Windsor Station, Montreal

In the construction of the exterior of the building, limestone from the Province of Quebec was used. The steel was manufactured at Lachine by the Dominion Bridge Company. The ornamental ironwork and bronze were of Canadian manufacture. The woodwork was made by Montreal manufacturers, and the plumbing was done by a Montreal contractor, and the electric fixtures by a firm in Toronto. In the exterior marble is used exclusively in the principal halls and corridors.

On six tracks the sheds will cover a train 1,000 ft. long, on two of the tracks, the roof covers a train 800 ft. long; on two more the capacity of 550 ft., while on Track No. 1 particularly intended for suburban traffic, the capacity is 420 ft. Over 2,000 tons of steel have been used in these sheds, exclusive of the concourse. The area covered is 205,000 sq. ft. or about 5 acres.

The roofs of the train shed are carried out on a new design. The skylights are designed as to be always clear, and snow can be shovelled through slots in the roof to the cars below.

The C.P.R. Hotel, Vancouver

OUR illustration is from a photo showing the progress made upon the construction of the C. P. R. Vancouver Hotel, Vancouver. The old hotel, now being torn down, was, twenty years ago, the only building in the block, on the corner of Georgia and Granville streets. Some three years ago the How street wing and annex were built of reinforced concrete, the banquet hall is now being used as a dining hall during the construction of the new building. The Van Horne wing of the present hotel will evidently be torn down to make room for the new hotel.

The power house, which supplies both heat and light to practically the whole block, was then erected. The upper portion of the power house is used for laundries, and employees' quarters. The lower part, containing the boilers and engine room, goes down nearly three storeys underground. There are three immense boilers, capable of using either coal fuel or oil fuel. Oil fuel is being used at the present time. The auxiliary engine room extends from the power house to the motors, hydraulic pumping and refrigerating machinery. Tunnels are run from the engine room and power house containing the pipes for heating and pumping purposes. Opening off from the auxiliary engine room is a large incinerator for the purpose of burning all rubbish. The engine room of the power house is located just below street level and is fitted out with the latest recording instruments, showing the consumption of fuel oil, pressure of steam, thermometers, etc., all working automatically. The power house is finished throughout, both inside and out, with cement.

Vancouver Hotel under construction

The main portion of the new hotel, which is in the course of construction at the present time, was started something over nine months ago, and is about three-quarters finished. It will be constructed of steel, with concrete floor slabs, and will tower sixteen storeys above street level, with three storeys underground. The roof, when completed, will contain a roof-garden.

The kitchen is planned on the Old Country style. A complete bake house will be installed, as will also complete refrigeration and storage rooms, butcher shop, etc. Electricity, gas and coal are used for cooking purposes. The kitchen will be finished in tile work throughout.

The main floor of this wing will have a tea room and lounge, floors being of mosaic marble work, and walls of Austrian oak. The ladies' tea room will be oval in shape, with large marble columns, and ceiling of glass. There will be 283 bedrooms in this wing, with telephone in every room, while practically every room will contain a private bath.

The base of the exterior of the hotel will be of granite, the upper part being of clayburn brick and terra cotta.

The old hotel will be replaced by the Granville street wing of the new hotel. This section of the building will be partly seven and partly eleven storeys high, and will contain 126 bedrooms, each room with a private bath. The most notable features in this portion of the hotel will be the huge convention hall, large grill, bar room and barber shop. It will also contain a public ticket office and billiard room.

At least 18 months will pass before the Van Horne wing of the present hotel building will be torn down, and the Marpole wing of the new hotel erected in its place. The Marpole wing, when constructed, will be eleven storeys high and will contain 60 bedrooms with private baths. There will be a large lounge on the main floor, and the sample rooms will also be in this section of the building. Throughout the entire new hotel, there will be in constant use about 20 elevators and dumb waiters.

The main entrance is to be on Georgia Street, with great pillars supporting the overhead protection of the driveway, which, starting from Georgia Street near Granville, runs in around the entrance, describing almost a half circle, and has its exit on Georgia Street near Howe Street.

Mr. Francis S. Swales, formerly of Painter & Swales, is the architect, and the contractors are Messrs. Skene & Christie, who constructed the Empress Hotel at Victoria.

The first Canadian Roads Congress, a national convention arising out of the urgent need in all the provinces for better roads, is planned to be held in Montreal about the end of January. Both the federal and provincial governments are co-operating with the Automobile Club of Canada, as well as the local and foreign roads associations, boards of trade, municipal and county councils and societies in general, to make the congress a big educational feature. The best methods of road-making will be reported upon by geological committees in the different provinces, and the most up-to-date methods in road construction will be explained by experts and contrasted with the old-fashioned methods of the past. The importance of this congress and the interest to be evinced in it may be inferred from statistics drawn up by the Automobile Club. These show that over 12,400 more motor vehicles were in use in the Dominion on November 1st than at the end of last year.

The provincial government of British Columbia has expended the large sum of four million dollars on road extension and improving roads within its boundaries during the past season. It is pointed out by the Deputy Minister, Mr. W. W. Forster, that the sum required for road maintenance year by year is rapidly increasing, owing to the additional mileage. There are at present in the province 18,000 miles of roads and trails. Upon bridges the sum of $900,000 has been expended by the Provincial Works Department this year, $50,000 for wharves, and $70,000 on road location work.

Glossary of Terms Used in Road Construction

(Continued from last issue.)

Course.—Applied to the various layers of metal or other material spread on a road, such as bottom course, top course, etc. "Crust" is sometimes used instead, but there is some confusion in the use of these words. "Course" is also used to describe the rows of paving setts or wood blocks.

Court.—A walled-in space, but generally applied to a group of houses in an alley.

Crab.—A portable windlass.

Crawl.—To creep slowly, applied to bituminous mixtures which creep under heat.

Craze.—Slightly to crack or split open the skin of a surface.

Creep.—See "Crawl."

Crempoid.—The trade name of a dust palliative.

Creosote.—A powerful antiseptic obtained from coal tar, and used extensively in the preservation of wood blocks.

Croft Blocks or Flags.—The trade name for a specially prepared artificial stone.

Crossfall.—See "Camber."

Cross-grip.—A cutting or channel across a road to divert the surface water from one side to the other.

Crossing.—A term used to designate a passageway, which is generally paved, over a street or road.

Cross-road.—A road intersecting another road, but sometimes used to designate a by-road traversing the country.

Crows.—Often used to designate the centre of a carriageway or the top of the camber.

Crude.—Untreated, raw, in a natural state; often used as a qualifying description in referring to tar, oils, etc.

Crumble.—To fall or break into small pieces or fragments.

Crunch.—A synonym for "crush."

Crusher.—Sometimes applied to a "stone breaker."

Crusher Run.—A term applied to the unscreened product of a stone breaker.

Crusher Sand.—The sand or small stuff remaining after stone has been crushed or broken in a stone breaker.

Crust.—The external covering of a carriageway; it is sometimes qualified as upper and lower crust if there are two layers making up the formation.

Cubes.—Setts which are actual cubes in measurement.

Cul-de-Sac.—A street open at one end only. A narrow street of this description is often called a "blind alley."

Culvert.—An arched drain of brickwork or stone carried under a road for the passage of water. A culvert is distinguished from a bridge if not of more than 6-ft. span.

Cups.—A term applied to hollows or depressions in the surfaces of a carriageway. (See also "Potholes.").

Curb.—Generally spelt "kerb." The edge stone of a sidewalk or footwalk. Sometimes called curbstone.

Curtilage.—A courtyard; or, in law, a court-yard, back, side, or piece of ground lying near and belonging to a dwelling-house.

Curvature.—The contour or camber of a carriageway surface.

Cushion.—Or cushion bed. A bed of sand or ashes, etc., laid between any paving and the concrete foundation.

Cyclometer.—An instrument for measuring the distance travelled by a vehicle.

Dacite.—A road-making rock, coming under the trade name of "Andesite," as settled by the Engineering Standards Committee.

Dandy.—A portable can for the distribution of tar or bituminous binder. Also used to designate a portable mixing vessel.

Dapping.—Or "dabbing." The use of a broom to drive tar into the interstices of the surface of a carriageway.

Dead Oils.—Oils distilled from tars with a density greater than water.

Decay.—To deteriorate, waste, wither or rot, moulder or fail gradually.

Decimetre.—A French measure = 3.937 in.

Declivity.—A steep descent.

Deformation.—A distortion or disfiguration.

Degredation.—The wearing down of stones, rocks, etc., by the action of water or other causes.

Dehydrate.—To remove all water from tars or other materials.

Deliquescent.—Capable of attracting moisture from the air and retaining it.

Dell.—A small narrow valley or ravine.

Density.—Used to describe the quality of being close or thick in direct proportion to the mass and volume of some substance used as a standard, and inversely proportional to the bulk or size.

Denudation.—The act of making bare. (See also "Degradation.")

Deodoriser.—That which destroys smell.

Depot.—A place of deposit.

Depression.—A hollow, or concave falling in, of the surface of a carriageway. The state of being pressed down.

Derrick.—A boom supported by posts and stays. The name is derived from that of hangman Derrick.

Detergent.—Any substance that has a strong cleansing power.

Detour.—A deviation from the direct or shortest path.

Detrition.—The act of wearing away.

Detritus.—Waste or disintegrated material. Specially applied to the mineral matter washed or scraped off the surface of carriageways.

Diabase.—A road-making rock, coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Diffuse.—To pour out and spread on a surface.

Dilute.—To make more liquid.

Dingle.—A narrow vale or valley.

Diorite.—A road-making rock, coming under the trade name of "Granite," as settled by the Engineering Standards Committee.

Direction-post.—Or sign post. A post indicating the direction of certain places at the bifurcation of roads.

Dish.—A term sometimes applied to a hollow depression in the surface of a carriageway; and, as a verb, to denote the act of making a hollow or depression.

Disintegration.—The act of separating the component particles of a substance as distinguished from decomposition.

Distributor.—A machine for spreading bituminous or other liquid substances upon the surface of carriageways.

District Roads.—A term applied to roads which are repairable by the inhabitants at large through town and district councils.

Ditch.—A side drain of a country road.

Dog's Leg.—A term sometimes applied to denote a crooked lane

Dolerite.—A road-making rock, coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Dolomite.—A road-making rock, coming under the trade name of "Limestone," as settled by the Engineering Standards Committee.

Drag.—A skid or shoe on a wheel.

Drain.—A channel through which water or other liquid flows off

Dray.—A four-wheeled open wagon. Usually applied to a brewer's dray.

Dribbling.—Sometimes used to denote the placing of small quantities of material in depressions on carriageways to restore the surface to its original shape.

Drizzle.—A very fine rain.

Dryer.—A machine for drying stone or sand by the application of heat.

Duct.—A conduit for pipes, usually applied to the underground carrier of electric cables, etc.

Ductile.—Flexible or pliable, easily drawn out to a thread.

Dump.—To unload from a cart by tilting.

Dumping Ground.—The site where spoil is deposited.

Durability.—The capacity to resist wear, the power of lasting.

Durax.—The trade name of a method of paving with cubical setts of small size. (The same as "Kleinpflaster.")

Dust.—Fine, dry particles of earth or other matter so attenuated that they may be raised and wafted by the wind.

Dustabato.—The trade name of a dust palliative.

Dusting.—Sometimes used to designate the operation of street cleaning.

Dustroyd.—The trade name of a dust palliative.

Dynamometer.—An instrument for measuring force or power, especially that of men, horses, machines, etc., by means of springs.

Earth.—A generic term for soil, mould, etc.

Earth-up.—To cover with earth, or heap-up soil, earth, etc.

Easement.—A liberty or privilege without profit which one owner has in the estate of another owner; distinct from the ownership of the soil, such as a right-of-way, or right of drainage, etc.

Ease-off.—To soften or slacken, as applied to an angle or curve, etc.

Echelon.—Wedge-shaped.

Edge-iron.—A tool for cutting the grass verges of carriageways, etc.

Elastic.—The power of recovery from compression or tension.

Elastite.—The trade name of a bituminous compound for roads.

Elbow.—A sudden turn in a road not quite so acute as a "hairpin" turn.

Eminence.—A term usually applied to a hill of moderate elevation.

Emulsification.—The act of making an emulsion.

Emulsion.—A mixture prepared by uniting oil and water, generally resembling milk in appearance. (From mulgeo, to milk).

Encroachment.—Unlawful intrusion. Assumption of the rights and privileges of another.

Enhydrous.—Containing water within.

En Masse.—In the mass, or the whole of a number of things taken together.

Enrockment.—A mass of large stones thrown in at random to make a foundation.

En Route.—On the road, on the way to any place.

Epidiorite.—A road-making rock, coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Equestrian.—A person on horseback.

Erminite.—The trade name of a dust palliative.

Erratic Blocks.—Scattered stone boulders which are supposed to have been carried by icebergs during the glacial epoch.

Escarp.—To cut rocks at a very steep angle.

Espalier.—A sort of trellis work.

Esplanade.—A term generally applied to roads or broad paths abutting on the sea.

Evaporate.—To dissipate in fumes.

Excoriate.—To strip or tear off the skin of any material.

Excrescence.—A growing out or superfluity.

Expansion Joint.—A joint which allows for expansion. Generally applied to open joints in wood or other similar pavements to allow for the swelling of the material by moisture without disturbing the pavement.

Exude.—To discharge by "sweating," or under pressure.

Facade.—The front view or elevation of a building.

Face.—"The front or fore part," generally applied to the surface of a carriageway.

Facettes.—"Little faces." Generally applied to the faces of a crystal of of a stone.

Fairfield.—The trade name of a bituminous compound.

Fall.—A difference in level. Sometimes used instead of "gradient."

Fat.—Sometimes used to designate a concrete or mortar which is rich in cement or lime, or a mixture rich in bitumen.

Fatigue.—The weakening of metal produced by repeated vibrations or strains.

Fatty.—A word sometimes used to describe a mixture with an excess of bitumen.

Felsite.—A road-making rock, coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Ferro-concrete.—Concrete fortified or strengthened by steel rods or framing.

Ferromac.—The trade name of a special method of making roads with a cementitious powder.

Filler.—A term now applied to a thin surface coat or course of fine bituminous material which is used to fill the surface voids in a carraigeway. Sometimes called a "seal coat." (There is some confusion now existing as to the use of this word.)

Filling.—The material used for filling-in. Now sometimes employed to denote the material used to fill the voids or interstices in bituminous-bound carriageways.

Finger-post.—An almost obsolete word for a sign-post or direction-post.

Fissure.—A crack or narrow chasm.

Fixed Carbon.—The organic matter of the residual coke obtained upon burning hydro-carbon products in a covered vessel in the absence of free oxygen.

Fixity.—Stability.

Flag.—Or flagstone. Usually applied to a natural (but sometimes to an artificial) stone used for paving footpaths.

Flake.—A chipping or small piece of stone of a flat or thin nature.

Flaky.—A term used to denote road metal which has in it a large proportion of thin, flat pieces of stone.

Flanks.—Sometimes used to denote the haunches or shoulders of a carriageway.

Flexible.—Pliant, ductile, and yielding.

Flint.—A variety of chert found in the chalk. Flints used for road construction are known as pit flints, field flints, hand-picked flints, etc.

Float.—To smooth over the face of cement, mortar, etc.

Floating.—A term used as a substantive to describe a thin layer of cement and sand or similar material laid on concrete to form a true bed for blocks or setts.

Flocculent.—Coalescing and adhering in flakes.

Flour.—A term sometimes used to describe a very fine stone dust.

Flume.—A water channel driving a water wheel.

Flush.—In a manner so as to be even or level with anything else.

Flush Coat.—Sometimes used to describe a fine coat of bituminous mixture laid on the surface of a carriageway.

Fluting.—A narrow groove, channel, or furrow.

Flux.—A substance or mixture used to promote the fusion of metals or minerals. Also applied to certain materials used for softening the harder bitumens.

Fluxphalte.—The trade name given to a bituminous mixture.

Footpath.—The name formerly applied to a narrow path or way for foot-passengers only, across fields, etc., but now often applied to the footway. Sometimes called "Path," or "Pathway."

Footway.—The part of the highway used by foot-passengers, generally divided from the carriageway by a kerb, and raised above the level of the carriageway. Also called footpath, side-walk, path, pathway, parapet, causeway, foot pavement.

Fork.—The point in a road where it divides into two branches.

Formation Level.—The surface of the excavated or made-up ground on which a road is constructed.

Forward.—A word used in measuring to denote lineal measurement—i.e., "a yard forward."

Foundation.—Used sometimes to denote the solid ground on which the road formation rests, and sometimes to denote the lowest part of the structure of a road. (This is one of the words that requires an accepted definition, as it is now used very loosely.)

Founder.—To go to pieces. A road that has "foundered" requires entire reconstruction.

Free Carbon.—Organic matters in tars which are insoluble in carbon disulphide.

Freestone.—Stone composed of sand or grit. Unsuitable for road metal.

Fret.—To wear by attrition.

Friable.—Easily crumbled or pulverised.

Fringe.—A word sometimes used to denote the edge or borders of a road.

Frontage.—The extent of the front of any building or land abutting on a road.

(To be continued)

LETTERS

A Plea for the Adoption of the Quantity System

London, Ont., Nov. 13th, 1913.

Editor Contract Record:

I have been much interested in the discussions appearing in your paper from time to time regarding the advisability of adopting the Quantity System among the contracting fraternity of this country.

In my opinion the owners who erect buildings lose large sums of money annually, owing to the present system by which contractors figure off their own quantities. Architects cannot fail to have noticed when opening tenders the great difference between the various amounts, whereas if proper figuring had been done there should hardly be any difference. This is not due, however, to one contractor having to buy his material at a lower or higher price than his fellow competitor, for all contractors are aware of the prevailing market prices of the material required in their respective trades. But it is due to a slip in taking off their quantities that this noticeable difference in the highest and lowest bid occurs. To come to the point where the owners lose money, let me recite the following (and I think, only those of limited experience will disagree with me). We insert a clause when calling for tenders, "the lowest or any tender not necessarily accepted," which to my mind is a farce, for in ninety-nine cases out of a hundred, the man who has gone so far as to incur architects' fees for plans invariably builds from the plans so prepared; in very exceptional cases, even against the advice of the architect, he will insist on the lowest bid being accepted, even though by comparison with other tenders he knows the contractor must have left out something, or made a slip. This class of owner is usually a very hard man to do business with, just one huge "grabber" from start to finish. However, as he forms a fair percentage of architects' clients we will consider his position, as not many architects in these days of earnest competition can afford to turn him down when he comes along and offers us his business. Unless the contractor finds out his mistake before the contract is signed (I speak of course where no deposit is required to be forfeited should the successful contractor fail to carry out the work upon which he submitted a figure) the owner signs up his contract with Mr. Contractor, and shrugging his shoulders he walks away thinking, "Well, I got that cheap enough, the contract is signed, and it's up to Mr. Architect to make Mr. Contractor live up to his agreement." But, I ask, does he get his job cheap enough? All architects know the worry and annoyance he will have to stand through such a bargain; all of us know what it is to have a contractor skimp his work, and of the daily visits to our offices of our client, who sits on the job and rushes to the architect with every tale of woe he can think of; angry with complaints about lack of supervision; how he (the architect) is allowing Mr. Contractor to get away with inferior workmanship and material, and so on. We know this class of client, and by the time he has paid us our fee, we feel that we have earned our money many times over, and feel like kicking ourselves for not turning him down in the first place.

Now-a-days contractors are not fools, neither are they, as a rule, willing to give something for nothing, contract or no contract. It is hard enough in the majority of cases to get good value from contractors even when they are being paid for a first class job, let alone when they are called upon to provide something according to plans and specifications upon which they have omitted to figure. For example, one morning Mr. Architect goes to the job and asks why certain work is not being done; in blank astonishment the contractor looks up and says, "Why I never figured on that, it's not in the specifications." "Oh yes it is," replies the architect, then follows a scramble to the shed where the specifications are located, wrapped in the blueprints under a pile of tools, or behind some bags of cement, in fact anywhere but in a proper place to preserve them. A careful survey of the plans and specifications follows, and presently the contractor finds he has missed out something else, and then the fun begins, it is a battle of wits all through, whereas nothing but pleasant relations should exist between everyone. But woebetide the proprietor should he require changes made or extras done as the work progresses, for it is only a rare occurrence that the Owner does not require to deviate from his original intentions and change his mind before completion of his job. For any little changes or extras, the Contractor boosts his price many hundred per cent. over the price as rated in his tender, and after all who can blame him? It is only human nature for him to want to make good his oversight while he has his chance, and here it is that a proper bill of quantities would save the contractor from his oversight. In the first place it would save the architect no end of conflicting interviews and numerous trips to the job, and lastly it would save Mr. Proprietor from being everlastingly soaked for extras.

Let us suppose the architect refuses to pass the contractor's account, and the case goes to court. It is up to the proprietor to prove the contractor's charge is unreasonable, and in nine cases out of ten judgment is given for the contractor, as he is better prepared with evidence, time sheets and pay roll, material invoices, and witnesses. We have all been through such experiences, so I need say no more than express an opinion that in the end the proprietor pays very dearly for entering into such a contract, and regrets not taking our advice in the very first instance and have nothing to do with accepting such a low figure; he certainly lacks his architect's sympathy for insisting upon taking advantage of another man's ignorance, in fact every one is sore.

I do not wish to infer that a bill of Quantities would eliminate mistakes, for while the world lasts mistakes and bad judgment will occur, but I do strongly feel that by the adoption of a system of quantities, such as I herewith propose, a basis would be established for a satisfactory remedy for any mistakes that were made. My suggestions are as follows:—

1. The bill of quantities should form a part of the contract, and all prices or rates quoted therein should be taken as a rate upon which all extras and deductions are charged.

2. An item designated "Preliminaries and Sundries" should be inserted, to include only those items of the "General Conditions" which can be priced individually, such as setting out the work, water, scaffolding, hoarding, etc. The contractors should refer to the specification and "Conditions of Contract," and have a note made to the effect that these works are to be considered to include for any expenses in connection with the general clauses therein.

3. Then should follow the different trades, excavation, concrete and brick work for example; proper dimension sheets with columns should be kept by the surveyor taking off the quantities, showing step by step how he arrived at the final total inserted in his Bill, so that if any claim for extras or deductions be made these figures could be checked over with the actual measurements on the job. The brickwork should all be reduced to a wall of one thickness, with special mention of any work requiring extra labour. This latter rule applies to all trades, and the following examples will better illustrate my meaning.

BILL OF QUANTITIES of Material required and work necessary for the Erection and Completion of a Residence for Mr. X, at No. ?? .... Street, Kalamazoo, in accordance with the accompanying plans and specifications:—

Messrs. A & B, Architects,
City.

NOTE:—This Bill of Quantities forms a part of the Contract between the Owner and the Contractor.

Amount of Preliminaries and Sundries, under General Conditions ... ... $
600 yds. super. Removing top soil and grading ... ... $
115 yds. cub., Excavation for foundations, etc., at per yd. ... ... $
17 yds. cub., Concrete in footings as described ... . $
200 yds. super, Waterproofing in footings as described ... $
60,000 yds. super, Brickwork reduced to 1 brick thick laid in lime mortar as described, at per yd. ... ... $
200 yds. super, Extra only for brickwork in cement ... ... $
75 No. Setting Window frames and bedding ... ... $
4 No. Setting Door frames and bedding ... ... $

The foregoing I think will illustrate my meaning, but every item mentioned in the specifications or shown on the plans should be made a note of in the quantities; let us take a few examples of carpenter work.

300 No. 2 in. x 10 in. joisting, i.e., ? ft. B.M., at per M. ... ... $
76 No. 2 in. x 12 in. joisting, i.e., ft. B.M., at per M. ... ... $
3,000 ft. B.M. rough boarding ⅞ in. thick for protecting mason work and ——— ... ... $
Attendance and cutting for other trades ... ... $
250 yds. Super, Deadening Felt as specified, at per yd. $
Allowance for nails, screws, etc. ... ... $
700 ft. run pine base, prepared for paint ... ... $
200 ft., Extra labour only on hardwood base, prepared for stain ... ... $

Now let us take sheet metal work.

120 ft. run copper eaves troughing, at ... ... $
7 No. Extra labour only on mitred angles ... ... $
10 ft. run double swan necks to down pines ... ... $
60 ft. run down pipes and fixing to walls ... ... $

All the foregoing illustrations are merely given as a guide, and when the time for settlement comes, everyone at a glance can see exactly what the contractor figured on, and arrive at a proper amount to be paid for any extras or deductions as the case may be. It should of course be thoroughly understood beforehand that the rates quoted by the Contractor in his original bill of quantities are to hold good for pricing extras or deductions, and a fully priced and added bill of quantities sealed in the envelope should be deposited with the architect at the time the contract is signed. I might say that I have known cases where a proper bill of quantities was handed to a contractor for a fairly large job, and the contractor only took a short glance at the plans, priced out the bill of quantities, read the specifications, and sent in a bid which was accepted. If my memory does not fail me I believe that in England very few of the contractors will figure on a job of any size unless a bill of quantities is furnished. The adoption of the quantity system would save contractors many hours of hard work, usually undertaken in the evenings when they are tired after working all day, and consequently all the more liable to make a slip.

In my humble opinion, the Builders' Exchanges throughout the Dominion should unite on this question and work in harmony with the various chapters of architects' associations to further this end, which would result in the ultimate abolition of the present slip-shod method of tendering. In a country like ours, where millions of dollars are annually spent on buildings, this question is one of great importance, and it is only by the united efforts of those identified with the building industry, that the quantity system will become an accomplished fact. Primarily it is up to the contractors to take the initial step to put an end to the waste of time and money involved in sending in a tender and refuse to bid unless a set of quantities is furnished. After that I think the architects will unanimously fall in line.

I have read the articles in your current issue, under the titles "The Gratuitous Bid" and "Competitive Tendering," and must say I thoroughly endorse all you have said with the exception of your plea that the "sole alternative is to pay the contractor for the trouble he is put to in tendering, and to reimburse him any expenses he may incur." This I think would be going to the other extreme, because a contractor who might have an idle half hour on his hands would then take the nearest trip to an architect's office and figure off a job, send in a bid although he might never have intended to try and get the job, his object in coming into your office being apparently to get under cover during a heavy shower and incidentally pocket a fee for putting in a bid. Even suppose a contractor never did a job, he could make a tidy income by merely sending in bids which he never intended should be accepted. The contractor should I think, sell his goods and labour like any other business man, and not be paid a fee for telling us his price; at the same time conditions should be made as easy as possible for him and he should not be expected to lose money because we ask him to tender. After considering the question from all sides, I cannot fail to come to the conclusion that many of us who are earning a living by being identified with the building business would find our day's work much easier and less full of pitfalls, should a universal system of tendering by quantities be adopted.

I trust, Mr. Editor, that you will follow up this matter and arouse such an interest in this important question as will ultimately lead to the adoption of the system of tendering by quantities.

Yours very truly,
H. Bryan Gilbert.

Mainly Constructional

The News in Brief—From Coast to Coast

A most important scheme for the improvement of roads in Manitoba has been announced by the premier, Sir Rodmond Roblin. The project provides for an expenditure of $2,500,000.

Montreal is to have a new apartment house firm in the Oldfield Apartments Company, Limited, whose incorporation has been announced in the Canada Gazette. The capitalization is $500,000.

The Dominion Government has awarded the contract for the construction of the Nassau dam on the Trent Canal to Chambers, McCaffrey & McGuigan, contractors, Toronto. The contract price is $72,768.

The Union Switch Signal Company, of Montreal, has been given the contract for automatic signals on the Intercolonial Railway, costing $85,000. The contract was awarded by the Dominion Government.

The death occurred on the 11th instant of Mr. Henry Benallich who was for the past twenty years one of Guelph's foremost contractors. The deceased was born in Truro, Cornwall, England, in 1843, and came to Canada when a young man.

The Industrial Foundation & Waterproofing Company have executed the damp-proofing of the exposed superstructural walls on the Loew Theatre, Yonge Street, Toronto. Messrs. Fleischman Brothers, Limited, were the general contractors.

A programme is under consideration for the carrying through of the $400,000 storm sewer project in London, Ont. Mr. Willis Chipman, of Toronto, and City Engineer Ashplant, of London, are conferring in the matter and the work will probably soon be in the hands of the contractor.

The General Supply Company of Canada, Limited, Winnipeg, have removed to their new offices and warehouses at 85 Water Street. The company's business in the western metropolis has increased considerably of late and the removal is undertaken with the idea of securing improved facilities.

The Saskatoon Builders' Exchange have passed a resolution expressing their unanimous disapproval of the action of the city council in requiring the building contractors to pay for the water they use at the meter rate, and calling for the appointment of a committee to wait on the Commissioners.

Work has already commenced on the new Welland ship canal. Operations have begun at Port Weller, the new town located at the Lake Ontario entrance to the new canal. Immense piers a mile and a half long and forming Port Weller harbor are being built by the Dominion Government at a cost of over three and one half million dollars.

Mr. A. D. Swan, the former assistant engineer of the Montreal Harbour Board, has returned to Montreal after spending several months in Central and South America. He also visited Kingston, Jamaica, in connection with a coal plant project. His object in visiting Central and South America was to report on some schemes for British capitalists.

The Dominion Government are inviting tenders for the construction of the two new piers that are a part of the huge development scheme in connection with the outer harbor at Victoria, B.C. Contracts for the construction of these piers will be let before the close of the year. The specifications call for ferro-concrete and the substructure will be of reinforced concrete.

That there is a serious lack of housing accommodation in Fort William is evidenced by the fact that although some four hundred dwellings have been erected there since last spring, living quarters are now even scarcer than ever before. It is pointed out that industries now nearing completion will have the effect of increasing the population enormously in the near future, so that the urgency which exists for more housing accommodation will be readily realized.

The amazing growth of some of the western provinces is indicated by the fact that four million dollars have been spent this year in British Columbia in building new roads and trails. The most notable achievement was the progress made on the Banff-Windermere motor road. The fact that plans are now being prepared for five million dollars worth of new civic work in Vancouver for next year seems a good augury for the building trade.

According to a return issued from Edmonton there was a falling-off in the number of building permits issued for the month of October. The total of $546,925 is a decrease in comparison with the same month of last year of $285,025. So far this year there have been issued permits to the value of $8,808,100. For the corresponding period in 1912 the amount was $13,011,352, which shows a falling off for the present year of $4,203,252 up to date.

The construction of the new terminal pier at Halifax is nearing completion and the dock is expected to be ready in time for the winter shipping traffic. As it now stands the pier extends almost 700 ft. out into the harbor and next summer it is planned to add another 100 ft. Extensive additions are also being made to the Immigration sheds, and a wall two storeys high is reared up across the full breadth of the property, about 150 yards.

Early next year a Canadian Roads Congress will be held in Montreal, with the object of bringing together the leading authorities on good roads, representatives of the Federal and Provincial Governments, municipal authorities, automobile associations, engineering societies—in fact all those interested in the good roads movement. Papers will be read on various aspects of the question, and it is also proposed to exhibit specimens of road materials and models of different kinds of machinery.

The name given by the C. P. R. to the new town a few miles south of Medicine Hat, where the Canada Cement Company is building its $2,500,000 plants, is Dauntless. It was formerly called Delano, but owing to confusion with a place in Alberta called Delano, the railway company decided on the change. While Delano post office is not on the railway, post matter and freight intended for Delano was sent there, much to the annoyance of shippers and recipients, as well as of the railway company.

Mr. Fuller, Architect of the Public Health Department, Ottawa, having examined the plans and specifications of the new Armories Building in course of erection at Amherst, N.S., has recommended a number of changes in the plans with a view of still further improving that building, which when finished is expected to be one of the most up-to-date of its kind in the Maritime Provinces. Messrs. Rhodes, Curry Company, Limited, are the contractors for the building, which will be completed by next fall.

The Ontario Gazette announces charters for the following companies:—The Lake Superior Drydock & Construction Company, Limited, Sault Ste. Marie, capital $1,500,000; Weseloh, Goudie Limited, Berlin, capital $200,000; Auto-Transportation Limited, Toronto, capital $150,000; Cornhill Limited, Toronto, capital $100,000; The Ramsden Sand, Gravel & Brick Company, Limited, Toronto, capital $100,000; The Nash Realty Company, Limited, St. Catharines, capital $100,000; John Heard & Company, Limited, St. Thomas, capital $75,000.

The corner-stone of the Toronto Housing Company's second building development at Bain Avenue, Toronto, was laid recently by the Hon. W. J. Hanna, Provincial Secretary, the ceremony being presided over by the Lt.-Governor Sir John Gibson. In addition to the Logan Avenue frontage, the whole work when completed will cost in the neighborhood of five hundred thousand dollars, and will include a central plant for the distribution of heating and hot water for domestic purposes. Accommodation will be provided for about two hundred families. It is expected that about half of the houses will be ready for occupation next spring. Application has already been made for a considerable number of the houses.

Canadian Railroad Development

According to Mr. S. P. Brown, chief engineer of the Mount Royal tunnel, the borings from the two shafts will meet on December 15th.

The new C. P. R. hotel at Calgary, which involves an expenditure of $1,500,000, is now nearing completion, and will be ready for opening by January. The hotel is nine storeys high, and the contractor for the work is Mr. P. Lyall.

New tenders will probably have to be called for the new Intercolonial terminals at Halifax. Tenders were received by the Railway Department, but is stated that none of these meet all the requirements. The whole work will cost upwards of $15,000,000.

The Montreal city engineers have prepared estimates of the cost of raising the Grand Trunk Railway tracks from Bonaventure Station to Point St. Charles. The cost is put at $5,500,000, while the Grand Trunk estimates it at $5,760,000. The City will have to bear a portion of the cost, and the Railway Commission will determine the amount to be so paid.

Mr. J. B. Armstrong, chief engineer of the Hudson Bay Railway, has resigned and is succeeded by Mr. J. Porter, who is on Major Leonard's staff in the construction of the National Transcontinental. It is understood that the head office of the Hudson Bay Railway construction department will be moved from Winnipeg to Le Pas. Mr. Armstrong proposes to go into the contracting business.

Mr. McLeod, railways and tramways engineer of the Montreal Council, has prepared a report outlining additional lines required in the outer wards, but the Tramways Company have declined to consider any building of fresh tracks until the company are granted more facilities for handling traffic in the centre of the city. Notwithstanding this, the Board of Control have been authorized to continue negotiations with the company.

Mr. R. P. Motley, the chief engineer of bridges of the C. P. R., has given some information as to the rebuilding and double-tracking of the bridge at Lachine, P.Q. The structure occupied three years in building, this extended period being due to the necessity of not interfering with the traffic on the single track of the old bridge. There were in effect, says Mr. Motley, two bridges, each of single track, traffic being shifted from up stream to down stream until the new track was finished. By June, 1910, the steel and masonry work were proceeding together, and the first half of the bridge was completed between June, 1910, and March, 1912. Last spring, the old spans were taken down and the last of the channel spans installed. Between April 21 last and October 21, the last five old spans—two 270 feet, two 408 feet, and one 120 feet—were taken out and five new spans of similar length erected. In connection with the work of building the bridge 3,500,000 rivets were used. The bridge is five-eighths of a mile long.

The Diamond Band Saw

A new departure and a complete revolution in the method of cutting stone was recently demonstrated at George Anderson & Company, of Canada's Scotch Works, Carnoustie, before many interested witnesses, amongst others Mr. F. E. Wallis, of Messrs. G. E. Wallis & Sons, Maidstone; Mr. J. H. Woodward, of Messrs. Holland & Hannen, London; and Mr. J. C. Wolstenholme, of Messrs. Walton, Goody & Cripps, Limited, London, who had travelled up to the works for the purpose of inspecting this machine.

George Anderson & Company have been experimenting on this method of cutting stone for the last four years, and have had to contend with numerous difficulties, owing to there being no data or experience in band saw practice for this particular purpose. Wood and iron band saw experience having been found quite useless in designing this machine, each step in the design had to be proved separately to find out what was best for this purpose.

To briefly describe the machine, it consists of two steel pulleys carried on four cast iron columns, these pulleys being so arranged through friction gear as to move simultaneously in a vertical direction at different speeds to suit the cutting. These pulleys carry the band, which runs at a speed of a mile a minute, the lower cutting edge of the band being fitted with diamond sockets at intervals of 3 in. to 4 in., and liberally supplied with an automatic water feed at the entering side of the stone. The whole of the machine is belt driven by a motor mounted on the machine. The feeds, belt moving gear, clutches, etc., are all operated from one position, the operator only having to mount his stone on a bogie and run it under the saw, start his machine, set his feed, and the machine automatically cuts the stone correctly.

The first cut taken was of Portland stone, blocks measuring up to 8 ft in length being negotiated, the cutting rate being 1½ in. per minute. The motor was connected to an ammeter, which showed the power taken. At this rate of cut 12 h.p. was required, and the band showed that no depreciable strain was being put on when cutting, as there was practically no tendency for the band to rise up against the pressure pulleys. A cut was taken right through the stone to the depth of 12 ins., and gave a perfectly clean surface ready to go on to any building without further attention, those present being particularly enthusiastic about the excellence of the surface left. A fresh cut was taken on the same stone at the rate of 3¾ in. per minute, when the power absorbed rose to 35 h.p., and no appreciable difference was shown at the finish of the cut. Some of the gentlemen present were rather sceptical about the results on marble, but on Sicilian marble being substituted for Portland stone, no variation was shown in the horse power taken or in the output. As a further test, a block of Cornish granite was placed on the machine; this was cut at the rate of 3 ins. per minute without any difficulty, a thing unheard of in the previous annals of stone working history.

For some reason, it has been considered that circular diamond saws could not cut granite. This was an erroneous impression, but it was certainly held that diamonds could not cut granite economically. In the rase of the band saw, the action of the band is different from that of the circular saw, for the band saw action is in the nature of a continuous scrape, rather than in the manner of a continuous blow and scrape as in the case of the circular saw. There is no reason to doubt therefore, that the diamond band saw has solved the problem of fast cutting of granite.

The machine under test has been installed at Haley's, Ont., for the Renfrew White Granite Company, and it is expected that a full and severe test in thorough keeping with our Canadian stone yard practice will be made during the next week or two.

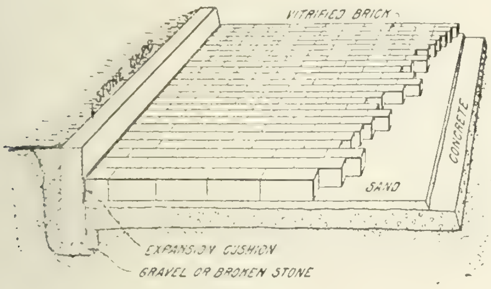
Brick Paving for Country Roads

Information Relative to Preparation, Construction and Cost

COUNTRY roads paved with vitrified brick are becoming quite common, and, owing to the general satisfaction which these roads are giving when properly constructed, it is probable that their mileage will continue to increase rapidly. The principal advantages which brick roads possess may be stated briefly as follows: (1) They are durable under heavy traffic conditions; (2) they afford easy traction and good foothold for horses; (3) they are easily maintained and kept clean; and (4) they present a pleasing appearance.

The principal disadvantage is the high first cost. The defects which frequently result from lack of uniformity in the quality of the brick or from poor construction are usually to be traced indirectly to an effort to reduce the first cost or to a popular feeling that local materials should be used, even when inferior.

In the preparation of the subgrade upon which a brick pavement is to be constructed, the essential features to be considered are thorough drainage, firmness, uniformity in grade and cross section and adequate shoulders.



Proper construction of stone curb.

Strong durable curbing should be supplied both on the sides and at the ends. Otherwise, the marginal brick will soon become displaced by the action of traffic and deterioration will spread over the entire pavement.

Satisfactory curbing may be constructed of stone, Portland cement concrete, or vitrified clay shapes made especially for this purpose. With stone the individual blocks should be not less than about four feet long and should have a depth of about 18 to 36 inches, depending on traffic conditions and on whether the curb is to project above the surface to form one side of the gutter. A thickness of four inches will ordinarily prove satisfactory. Stone curb should always be set on a firm bed of gravel, slag, or broken stone, not less than three inches thick, and should be provided with a backing of the same material on the shoulder or sidewalk side. Fig. 1 shows a typical stone curb in place.

Concrete curbs may be constructed alone or in combination with either a concrete gutter or a concrete foundation. The advisability of constructing a curb in combination with the foundation, however, is doubtful. Concrete curbs should have approximately the same cross-sectional dimensions as stone curbs and should be constructed in sections not exceeding about 7 or 8 feet in length.

Vitrified clay curbing should be set in much the same manner as that described for stone curbing. The principal additional requirement is that, since vitrified clay is a lighter material than stone and the curb sections are ordinarily shorter, the bedding must be made correspondingly more secure in order to prevent displacement.

The proper type of foundation depends largely on the material composing the subgrade and the character of traffic for which the road is designed. Where the traffic is comparatively light and the subgrade is composed of some firm material which does not readily absorb water, a very satisfactory foundation may be constructed of broken stone or gravel filled with sand. Where the traffic is comparatively heavy, however, or where the material composing the subgrade is defective in any way, a monolithic concrete foundation should be used.

Gravel and broken-stone foundation may be spread in one or more courses, each of which should be from 5 to 9 inches thick before compacting. The stone or gravel should be clean, hard, tough and durable and should be graded in size between certain reasonable, fixed limits. It should be compacted in the usual manner by rolling with a power roller weighing not less than about ten tons, and sufficient clean, coarse sand to fill the voids should be spread and flushed into the foundation while the rolling is in progress. When complete the foundation should present a surface uniform in grade and cross section and parallel to the proposed surface of the finished pavement.

Concrete foundations are unquestionably better adapted for brick pavements than any other type. They are practically monolithic in form, nearly impervious to water, and possess a relatively high crushing strength. All of these qualities may be obtained with a relatively "lean" concrete if the subgrade has been properly prepared. Under ordinary circumstances a satisfactory foundation may be constructed of concrete composed of 1 part of Portland cement, 3 parts of sand, and from 5 to 7 parts of broken stone or screened gravel.

It is necessary to provide an adjustable cushion of some kind between the foundation and the brick for correcting any slight irregularities in the surface and to secure an even bearing for the brick. Sand has been found a most satisfactory material and is almost exclusively used. The proper thickness for this sand cushion will of course depend on the extent of the inequalities. Two inches has generally proved very satisfactory.

After the cushion is spread uniformly it should be thoroughly compacted by rolling with a hand roller weighing from 300 to 400 pounds, and any depressions which form should be corrected.

The brick may all be hauled and piled at convenient intervals along the sides of the roadway before grading is begun. Hauling over the finished pavement with wagons until it is complete and opened to traffic should be avoided. If the brick are delivered on the work as needed, they should be unloaded from the wagons outside of the curb and carried to the pavers, either by hand or in wheelbarrows. Plank trackways should also be provided over the newly laid pavement for the wheelbarrows when they are used.

The brick should be laid on edge and in uniform courses running at right angles to the line of the pavement, except at intersections; and in order to "break the joints" each alternate course should begin with a half brick. In laying the brick the pavers stand on the pavement already laid and, beginning at the curb each time, carry across as many courses together as they can conveniently reach. The courses should be kept straight and close together, and if necessary each block of eight or ten courses should be driven back by means of a sledge and a piece of straight timber approximate-by 2 by 4 inches by 5 or 6 feet long. The brick should also be laid close in the courses and should be crowded together, if necessary, after a course is laid, by means of a crowbar inserted at the curb.

After the pavement has been laid and all defective brick have been replaced to the satisfaction of the engineer, the next step is to sweep the surface clean and smooth out all inequalities by means of ramming or rolling. The rolling should be done with a power roller weighing from 3 to 5 tons, and the pavement should ordinarily be rolled in both the longitudinal and transverse directions. The longitudinal rolling should be done first and should begin at the curbs and progress toward the crown. The roller should pass at least twice over every part of the pavement in both directions.

In order to keep the brick in proper position and protect the edges from chipping, it is necessary to fill the joints with some suitable material before the road is opened to traffic. The materials which have in the past been most commonly used for this purpose are sand, various bituminous preparations, and a grout made of equal parts of Portland cement and fine sand mixed with water.
used.

Sand is the least expensive of these materials, but there are several very serious objections to its use as a joint filler. Bituminous fillers vary considerably in quality and efficiency, but all are more or less unsatisfactory. One of the principal objections to their use is based on their tendency to run out of the joints into the gutters during warm weather and to crack and spall out during cold weather. This tendency can, of course, be partially overcome by exercising proper care in selecting the materials. It should also be noted in their favor that brick pavements, the joints of which have been filled with bituminous preparations, are ordinarily less noisy at first than those in which a Portland cement grout filler has been used. The grout filler is unquestionably very much superior from a standpoint of durability, however, and the excessive noise under traffic which has been frequently observed in connection with its use can be largely eliminated by the use of proper bituminous expansion cushions along the curbs. It is, therefore, recommended as better adapted for filling the joints in brick pavements than any other material which has been commonly used for that purpose.

Expansion cushions should be provided for at the time the brick are laid, by placing a board of the required thickness on edge adjacent to each curb. Small iron wedges may be inserted between the curb and the board at the time the board is set. These wedges may be readily loosened and removed after the bricks have been laid and grouted, and may consequently be made to facilitate the removal of the board.

The proper thickness for expansion cushions is a matter concerning which much difference of opinion exists among highway engineers. Some engineers advocate a minimum thickness of 1 inch, while others claim to have secured their best results by using expansion cushions having a minimum thickness as low as three-eighths inch for very narrow pavements.

The cost of brick pavements varies widely, and is affected by so many influences that it is difficult to attempt to derive a general expression showing the relation between probable cost and local conditions. The prices of brick, as also the prices of the various materials entering into the foundation, vary greatly according to the locality and the freight rate. The cost and efficiency of labor is also far from being constant. Furthermore, the material composing the subgrade and the method of preparing it may exert a marked influence on the cost of the pavement.

If C = cost of cement per barrel, S = cost of sand per cubic yard, A = cost of coarse aggregate per cubic yard, B = cost of paving brick per 1,000, and L = cost of labor per hour, with all materials considered delivered on the work and all costs expressed in cents, then the probable cost of constructing a brick pavement, including the subgrade, a 6-inch concrete foundation, and suitable curbs, may be estimated by substituting in the formula:

$$\text{Cost per square yard} = 1.90\,L + .213\,C + .138\,S + .157\,A + .045\,B.$$

The cost as estimated from this formula should, however, be increased by about 10 per cent. to allow for wear on tools and machinery and to guard against unforeseen contingencies. If it is desired to use a different thickness of foundation, it is safe to assume that each inch subtracted or added to the thickness of the foundation will make a corresponding difference of from 8 to 12 cents in the cost per square yard.

IN depositing concrete in deep water through a tremie the most difficult part of the operation is filling the tube at the start. As is well known, unless the tube is sealed in some way the cement will wash out during the downward passage and leave only a pile of stone and sand. This waste of concrete may in the case of a 12-in. tube 50 ft. long amount to more than 1 cu. yd. A simple but effective method of eliminating this waste used by Mr. G. W. Rear, general inspector of the Southern Pacific, was described by him at the recent convention of the American Railway Bridge and Building Association at Montreal. He starts with a 7 or 8-in. layer of planer shavings, which he covers with about 1 inch of cement. This forms a plug, and as the concrete is dumped on top the buoyancy of the plug and resistance of the column of water underneath prevent the first concrete from falling rapidly enough to wash out the cement; from then on the concrete itself serves as a seal.

SPEAKING before the Canadian Railway Club, Montreal, Mr. G. Percy Cole, M.Sc., Mem. A.I.E.E., Assoc. M.I.E.E., of the Canadian General Electric Company, advocated the electrification of railways as a means of conserving natural resources. He quoted figures to show the enormous cost of running locomotives by coal, and estimated that a saving of $2 per ton, or $147,000,000, could be saved in Canada and the United States if the railways were electrified. In the process of turning the coal into power we are throwing away 90 per cent. of its value—a serious national concern. When it is considered that 70 per cent. of railroad revenue from operation is obtained from the transportation of freight, it is easy to see why railway managers are beginning to study the question of electrification from the standpoint of economy.

Five and a-half million dollars is the estimated cost for raising the G. T. R. tracks from Bonaventure Station to Point St. Charles, Montreal, according to the report compiled by the City Engineer for the Board of Control. This estimate has been reached by Mr. McLeod, municipal and railway engineer. The cost, as estimated by the railway, is placed at $5,760,000.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.

Sewer extension on Mill and Lorne, planned by Town Council. Clerk, W. H. McFadden. By-law carried Nov. 10.

Ingersoll, Ont.

Watermains extension planned by Town Council (Fire and Light Com.). Chairman, Councillor W. Mills. Additional hydrants to be installed.

New sewage system, $59,000. Engineers, F. W. Thorold & Co., 2 Toronto St., Toronto. Plans drawn.

Medicine Hat, Alta.

Subway, $52,303, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. To be completed about July 27, 1914. Plans drawn.

Paving and sidewalks, cost $32,450, contemplated by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer.

Ottawa, Ont.

Coverings for wells planned by City Council. Mayor, J. A. Ellis. General contractors, Gibson & McCardie. 12 buildings, frame construction.

Port Arthur, Ont.

Commissioner of Utilities, J. J. Hackney. Construction of pipes, Drummond, McCall & Co., 28 Victoria Sq., Montreal. Duplicate pipe line of welded steel pipe 24-in. diam., line 5 miles long. Pumping station is planned by the City Council being erected at shore end of intake. System to be in operation by summer of 1914.

Regina, Sask.

Equipment for new filter bed planned by City Council. Contracts awarded as follows: Adams' Hydraulics Ltd., York, England, for 1 "Cresset" distributor, $843. Canadian Lock Joint Pipe Co., Ltd. Regina, for about 10,700 sq. ft. triangle wire mesh at 3c sq. ft., $321. Drummond, McCall & Co., Winnipeg, for one 6-in. gate valve, $22; one 12-in. gate valve $52. Canada Iron Carberation for supply of pipe.

A subway costing $50,000 is contemplated by City Council. Commissioner, L. A. Thornton. City Engineer, F. McArthur. Plans will be prepared this winter. Work to start next year.

The additions to filter bed, cost $14,700, planned by the City Council, have been completed. Commissioner, L. A. Thornton. City Engineer, F. McArthur. General contractor, O. W. Smith, 4 Peart Block.

St. John, N.B.

Street extensions are contemplated by City Council. Mayor, Mr. Hooper. Carleton and Aberdeen Sts. to be extended to new I. C. R. freight sheds.

Stratford, Ont.

Sewer, cost $10,500, Erie, planned by City Council. Mayor, C. N. Greenwood. Concrete arch to cover sewer. Plans in progress.

Toronto, Ont.

Asphalt pavement on roadway north of Withrow Park, estimated cost $5,000, recommended by Board of Control. Commissioner of Works, R. C. Harris.

Pavements recommended by Board of Control. Commissioner of Works, R. C. Harris. Asphalt pavement on Glenholme, Boultbee, Gertrude and Montclair. Estimated cost $8,010. Brick block on two lanes. Estimated cost $1,530.

Board of Control, Mayor H. C. Hocken. Commissioner of Works, R. C. Harris, recommend grading the following streets: Hiawatha Ave., $1,112; Glen Mount Park Rd., $13,630; Burgess Ave., $5,520; Sparkhall Ave., $2,280; Brookside Drive, $21,063.

Tenders received until Nov. 18th for sewers planned by Board of Control. Mayor, H. C. Hocken. Plans at office of Commr. of Works, R. C. Harris. Ascot, Springmount, Benlamond, Farrford and Dufferin. Midway Drainage System, Gerrard and Hiawatha.

Pavements planned by Board of Control. Mayor, H. C. Hocken. Tenders will be called after Dec. 13th. Asphalt on Cornwall and Renhold, estimated cost $4,927. Brick on lane east of Dovercourt, $5,908.

Tenders received by Engineer until Nov. 15th, for concrete walks on Baby Point Crescent, planned by York Twp. Clerk, W. A. Clark, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide E.

Wainfleet, Ont.

Tenders received by Reeve, on behalf of Council, until Nov. 27th for repairing and enlarging Beederman Drain. Plans, etc., at office of Reeve, P. J. Wilson, Marshville, Ont.

Welland, Ont.

Tenders received by Clerk, C. M. Webber until 4 p.m. Nov. 17, for sewers on Parkway, Cross, Fraser, Edward, Hooker, Queen, Cady, Cozy and Welland Sts., and sewer connections on North Main St., Division, Hellems, Burgar and Cross Sts. Plans and specifications at office of Engineer, also further information. Chairman of Sewerage Com., Jas. Hughes. Town Engineer, D. T. Black.

Winnipeg, Man.

Prov. Govt. Dept. of Public Works contemplate spending $2.500.000 on good roads. Acting Minister, G. R. Caldwell.

CONTRACTS AWARDED

Camrose, Alta.

The Municipal Council contemplate the purchase of road machinery. Commissioner of Works, Sydney Appleton. A concrete mixer and stone breaker will be required early next year. Commr. of Works will receive prices for both steam and gasoline units, which must be portable and self-contained.

Ottawa, Ont.

Intercepting sewer, cost $56,827, planned by City Council. Mayor, J. A. Ellis. City engineer, Arch. Currie. General contractor, Thos. McLaughlin, Sterling Ave. Brick and concrete construction.

Regina, Sask.

Paving planned by City Council. Engineer, F. McArthur. General contractors, National Paving Co., Ltd. For paving west side of Board St. subway, 2,796 sq. yds. at $5.60 per sq. yd.

Portable gasoline-driven centrifugal pumps required by City Council (Waterworks Dept.). Engineer, J. M. McKay, Supt. Waterworks Dept. General contractors, Canadian Fairbanks Morse Co., 300 Princess St., Winnipeg.

Toronto, Ont.

Special castings, cost $7,311, required by Board of Control. Mayor, H. C. Hocken. General contractors, Camden Iron Works, Camden, N.J. 20 in. and 36 in. special castings for waterworks system.

Sewer, cost $53,465, planned by Board of Control. Mayor, H. C. Hocken. General contractors, Fussell-McReynolds Co., Dundas St. Storm sewer, Argyle St., from Shaw to Gladstone Ave.

Pavements planned by Board of Control. General contractor, Commr. of Works, R. C. Harris. Asphalt on Coady, Edith, Hickson, Standish, Theodore. Daylabor. Estimated cost $15,247.

Concrete sidewalks planned by Board of Control. Alton Ave., to Grant Contracting Co.; Bain & Windeat, to Wm. E. Ransom; Carlaw Ave., to A. Gardner & Co.; Evelyn Cres., to Herbert Mitchell; Lee Ave., to Queen City Concrete Paving Co.

Pavements planned by Board of Control. Asphalt concrete on Givens from Queen to Halton, estimated cost $7,003. Bitulithic on Peel and Russell Hill Rd., estimated cost $3,160. Brick block on Derby Lane, $2,595, to Commrs. of Works, day labor.

Sewers planned by Board of Control. General contractors as follows:—Balmy, Lyonde, Spruce Hill Rd., Willow Ave., to McLaren & Co., cost $5,795; Bloor St. W., Grant Contracting Co., $2,150; Cedar Ave. and McLean, National Contracting Co., $1,456; Pine Ave., J. F. Connally, $3,425; Regal Rd., W. E. Taylor, $1,593.

Sewers, cost $79,600, planned by Board of Control. General contractors, The Godson Contracting Co., Manning Chmbrs. West Toronto Sewer Outlet Div. No. 2, Contract No. 3. Keele St. and Uttley Park.

Winnipeg, Man.

Additional concrete pavement, McMillan Ave., planned by Board of Control.

Sec., M. Peterson. General contractor, C. F. Campbell, Supt. of Asphalt No. 2, for grading construction, of artificial stone curb and gutter and base. General contractor, J. W. Astley, Engineer of Constr., for surfacing.

Sewer, cost $4,600, Waverley St., planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Engineer of Constr.

Water mains, cost $739.05, planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Engineer of Construction. Water mains on Burrows Ave., Ethelbert St., Grey St., Kent St., Wolfe St., Spruce St.

Railroads, Bridges and Wharves

Black Rock, Ont.

The G. T. R. has been authorized to construct bridge No. 62, mileage 152.25 from Black Rock over Public Road between Lot 12, Huron Road, Con. and Lot 83, Maitland, Twp. Goderich, Co. Huron.

Edmonton, Alta.

Bridge, over Sask. River. Mayor, Mr. Short, Civic Offices. Clerk, C. Cox, Civic Offices. City Engineer, A Latornell, Civic Offices. General contractors, Carter, Halls & Aldinger, Winnipeg. Piers in, work to be continued when river is frozen over.

Kingston, Ont.

The C. P. R. has been authorized to construct spur for Frontenac Floor & Wall Tile Co., Ltd., mileage 101.58, Ont. Div., Kingston Sub. Div., in lot No. 8 Con. West of Great Calaraqua River.

Listowel, Ont.

The G. T. R. have been authorized to construct siding into premises of Andrew Malcolm Furniture Co., Ltd.

Little Sands, P. E. I.

Breakwater planned by Dom. Govt. Dept. of Public Works. Ses., R. C. Desrochers, Ottawa. Tenders received by Secretary until 4 p.m. Dec. 3rd. Plans etc., at offices of Dist. Engineers, Charlottetown, P. E. I., and Halifax, N.S., Postmaster, Little Sands, and at Dept., Ottawa.

Mara, B.C.

The C. P. R. has approved the location of station at Mara in N.E. ¼ Sec. 8-20-8, W.6.M.

Province of Ontario

The C. N. O. Rly. has approved the location of station at Alice, mileage 96.65 from Ottawa.

The C. N. O. Rly. has location of station at Hiam, mileage 91.6 from Ottawa.

The C. P. R. has been authorized to construct bridge No. 9.17 on Nipigon Sub. Div., over Maggot River.

Ottawa, Ont.

Tenders received by Commissioners of Transcontinental Ry. Secretary, P. T. Ryan, Ottawa, until 12 o'clock noon, Nov. 27th, for 196,000 ties, to be delivered at Hervey Junction and La Tuque, Que., as per specifications. Specifications and further information at offices of Mr. Gordon Grant, Engineer, Ottawa, and A. E. Doucet, District Engineer, Quebec.

Port McNicoll, Ont.

The C. P. R. has approved the location of station in Lot 16, Con. 15, Twp. Tay, Co. Simcoe.

Regina, Sask.

Addition to car barns will not be undretaken at present.

The City Council contemplates building a timber bridge over the Wascana Creek at Elphinstone St. Commr., L. A. Thornton.

Rocky Point, P. E. I.

Wharf. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders will close with Secretary, Nov. 12th. Plans, etc., at offices of W. E. Hyndman, Dist. Engineer, Charlottetown, P.E.I., F. G. Goodspeed, Dist. Engineer, St. John, N.B., C. E. W. Dodwell, Dist. Engineer, Halifax, N.S., Postmaster, Rocky Point, and at Dept., Ottawa.

St. Catharines, Ont.

Bridge, cost $100,000, contemplated by City Council and C. P. Rly. By-law to be submitted to ratepayers.

Province of Sask.

The C. N. R. has approved location of station at Chandler.

Summerside, P. E. I.

Tenders for the repairs to breakwater planned by the Public Works Dept., have been received but nothing further has been done.

White River, Ont.

The C. P. R. has been authorized to construct bridge No. 35.92, White River Sub. Div., Lake Superior Div., near Goldie.

CONTRACTS AWARDED

Ottawa, Ont.

Automatic signals, cost $85,000, required by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones. General manager Intercolonial Rly., F. Gutelius, Moncton, N.B. General contractors, The Union Switch & Signal Co., Pittsburgh, Pa., and Montreal, Que.

West St. John, N.B.

Additional grain shipping and conveying galleries planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Jno. S. Metcalf Co., St. Francois Xavier St., Montreal. Steel, Dom. Bridge Co., Lachine. Electrical, O'Leary, 36 Recollect, and Gen. Elec. Co., 11 St. Sacrament.

Winnipeg, Man.

Paving bridge planned by Board of Control. Engineer, H. N. Ruttan, 223 James Ave. General contractors, Canadian Wood Preserving Co., Ltd., 305 Commercial Travellers Bldg., for supply of 1,300 sq. yds. of creosote blocks for paving Main St. bridge at $1.82 per sq. yd. General contractor, J. W. Astley, engineer of construction for laying creosote block pavement and constructing new sidewalk on Main St. bridge over Assiniboine River.

Public Buildings, Churches, Schools, etc.

Bienfait, Sask.

School contemplated by School Dist. No. 897. Treas., John H. McBeth. The Board of Trustees will borrow $2,000 for the purpose.

Beacon Hill, B.C.

School for School Board. Architect, J. C. M. Keith, 416 Sayward Bldg., Victoria. Tenders received by Secretary at office of Board of School Trustees until 4 p.m. Nov. 18th. Plans and specifications at office of Architect.

Berlin, Ont.

Church, cost $50,000, Benton and Church Sts., for St. Matthews Lutheran Church. Chairman of Bldg. Com., A. Sippel. Architect, W. H. Spear, Detroit, Mich. Carpenter, J. Baetz. Steel, Hamilton Steel Co., Hamilton. Excavating completed.

Edmonton, Alta.

Church, cost $30,000, planned by Norwood Presbyterian Congregation. Pastor, Rev. J. E. Duclos, Carey and Willow Sts. It has been decided to erect new church probably in spring.

Fort William, Ont.

Fire hall, cost $21,000, Pacific, for City Council. City Engineer, Ray R. Knight. Plans drawn. Tenders to be called shortly. Two storeys, 30 x 90, stone, common and pressed brick construction, concrete foundation, waterproofed, felt and gravel roofing.

Customs house, cost $175,000, May St. N., for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, M. H. Braden. Three storeys, 100 x 80, stone, reinforced concrete and brick construction. Excavating progressing.

Haileybury, Ont.

Court House and Registry Office planned by Prov. Govt., Dept. of Public Works. Secretary, H. F. McNaughten, Parliament Bldgs., Toronto. Tenders received by Secretary until noon, November 21st, for heating, plumbing and electric wiring. Plans, etc., at office of Sheriff, Haileybury, and at Department, Toronto.

Hamilton, Ont.

School furniture required by Separate School Board (Sherman Ave. N.) Sec.-treas. Com., Father Leyes, 260 Herkimer St. Seating, A. Thomson, Bay and York streets.

Addition to school, cost $82,000, Stinson St., for Board of Education. Sec. of Board, R. H. Foster, City Hall. Architect, A. W. Peene, Clyde Block. Tenders close with Architect, 5 p.m. Nov. 11. Two storeys, 10 rooms, brick construction, central heating plant, modern ventilating, slate roofing. Tenders open.

Mervin, Sask.

School planned by School Dist. No. 3045. Treas., H. Grant Dow. The Board of Trustees will borrow $2,000 for the purpose of securing a site, erecting and furnishing a school building.

Moncton, N.B.

Church, cost $62,200, Church and Queen, for First Moncton Baptist Church. Architect, C. B. Chappell, Charlottetown, P.E.I. General contractor, Jas. Reid, Moncton, N.B. Contractor changed. Building is to be floored this season and not completed until next year.

Montreal, Que.

Tenders are in for kindergarten school and janitors residence, for the Prot. Board of School Commrs., Notre Dame de Grace. Architects, Saxe & Archibald, 59 Beaver Hall Hill.

Church, Decarie Blvd., St. Lukes Congregational Church. Rev. W. R. Cruikshanks, 115 Drummond. Architects, Hutchison, Wood & Miller, Royal Insurance Bldg. Contract for foundation to be given this week. Tenders for general contract to be called about November 17th.

Fire station No. 3, cost $57,900, Ottawa and Young, planned by Board of Commissioners. Secretary, L. N. Senecal. General contractor, C. E. Deakin, 41 Mayor.

Post office, Maisonneuve, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, C. Dufort, 192 St. Catherine W. Architect changed.

Armoury, Sherbrooke W., for McGill College. Principal Peterson. Architect, P. E. Nobbs, 49 Beaver Hall Hill (University Architect). Plans in progress.

Hospital, cost $35,000, Cedar Ave., for Children's Memorial Hospital, Cedar Ave. Architects, Brown & Vallance, 44 Canada Life Bldg. General contractor, C. E. Deakin, 41 Mayor. General contractor will sub-let some trades. Foundations going in.

Fire and police station, cost $85,000, Bois de Doulogne, for Board of Commrs. Sec., L. N. Senecal. Architect, C. A. Reeves, 58 St. James St. General contractors, Picard & Balin, Gouin Blvd., Bordeaux, Que. General contractors may call for some trades. Excavating being done.

New Toronto, Ont.

Lodge hall contemplated by West Point Lodge of Oddfellows, No. 245. Three storeys, brick construction. Estimated cost $10,000. Work to start in spring.

Ottawa, Ont.

Alterations to St. Johns Evangelist Church Hall, Elgin St., costing $5,000. Carpentry, Taylor & Lackey, 1st Ave. Electrical, P. Ackroyd, 128 Bank St. Walls up.

Church contemplated by St. Lukes Anglican Church. Pastor, Rev. W. A. Read, 760 Somerset. Committee, Rev. C. L. Bilkey, W. Farmer, E. Foster, R. Barnett, Dr. Hollingsworth. Address members, c/o Pastor. Site will be purchased.

Prince Albert, Sask.

The Board of Trustees will borrow $26,000 for the purpose of completing and equipping George V., Queen Mary and Connaught Schools. Treas., C. O. Davidson.

Port Arthur, Ont.

Central school contemplated by the Board of Education. Chairman, Mr. Roberts. Trustee, J. A. Kennedy. Site selected, 264 ft. frontage x 165 ft. deep.

Market building, cost $12,000, planned by City Council. Mayor, J. A. Oliver. Clerk, T. F. Milne. Chairman of Com. in charge, Ald. Lester Cain, 20 Winnipeg Ave. Architect not yet appointed. Option for site accepted by Council Nov. 10th. Location, Lower Van Norman St. between Court and St. Paul streets. Work to start in spring.

Quill Lake, Sask.

School planned by School Dist. No. 936. Treas., John Buie. The Board of Trustees will borrow the sum of $5,000 for the purpose of erecting and furnishing school.

River Glade, N.B.

Hospital, cost $15,000, for the Jordan Memorial Sanitarium, c/o Dr. David Townsend, River Glade. Architect, F. Neil Brodie, 42 Princess St., St. John. To accommodate 100 patients. Concrete foundation, frame construction, felt and gravel roofing, birch floors. Plans in progress.

Regina, Sask.

Addition to car barns, cost $20,000, planned by City Council (Street Railway Dept.) Commissioner, L. A. Thornton. Supt. Street Railway Dept., H. Doughty. Plans will be prepared this winter. Work to start next year. Brick construction and foundation, corrugated iron roofing, electric lighting, concrete foundation.

Police station for City of Regina (Police Commission). Architects, Clemensha & Partnall, 1721 Scarth St. Consulting engineer, S. S. Kennedy, 211 Carlton St., Winnipeg, has been appointed to drawn plans for plumbing, heating and ventilating system for police station.

Collegiate, cost $35,000, contemplated by Collegiate Institute. Sec.-Treas., J. Kelso Hunter, 1818 Scarth St. Site purchased. Nothing further will be done until spring 1914.

Sarnia, Ont.

School, cost $30,000, planned by School Board. Chairman, A. N. Hayes, M.D., 142 Christina. Architect, Robt. W. Fawcett, 152 Essex St. To be completed early in 1914.

Province of Saskatchewan

The Board of Trustees will borrow the sum of $18,500 for the purpose of purchasing school site, erecting and equipping a school building. Treas., Cecil C. Forsham, Cando.

School contemplated by Riverdene School Dist. No. 3081. Treas., W. R. Miller, Calbri. The Board of Trustees will borrow $1,800 for the purpose of erecting and equipping a school building.

St. Agathe des Monts, Que.

Post office planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Finley & Gagnon, New Birks Bldg., Montreal. Tenders will not be called till some time in December. Plans drawn.

St. John, N.B.

Fire apparatus for City Council. Commissioner for Public Safety, H. McLellan. Prices wanted for gasoline pumping engine, motor chemical and hose cart. No tenders will be called.

Selkirk, Man.

Addition to hospital for insane planned by Prov. Govt. Dept. of Public Works. Minister, Hon. W. H. Montague, Winnipeg. General contractors, Carter, Halls & Aldinger, Union Bank Bldg., Winnipeg. Tenders received by Architect, V. W. Horwood, 261 Fort St., Winnipeg, until noon Nov. 24th, for plumbing and heating. Plans, specifications, etc., at offices of Prov. Architect.

Stratford, Ont.

Addition to Shakespeare School, Strachan, contemplated for Public School Board. Chairman of Com., Dr. Eidt. Chairman of Board, Jas. Stewart. Inspector, Jas. Smith. Red pressed brick construction, stone foundation, slate roofing.

Toronto, Ont.

A church, cost $40,000, is contemplated by Bellefair Methodist Church Congregation. Pastor, Rev. Dr. German, 8 Williamson Road. Institutional building, seating capacity 1,200. Will include gymnasium, library, etc.

Lodge Hall for Dian Loyal Orange Lodge No. 2054, 182 Rhodes. Secretary Building Committee, J. L. Bolton, 146 Hiawatha Rd. Architect, W. J. Morris. Two storeys, 25 x 65, brick and stone construction, gas and electric lighting, hot water heating, seating and lodge furniture required. Plans drawn.

Police station, cost $8,000, Centre Island, for Board of Control. General contractor, Property Commsr. Chisholm. Work being done by day labor under Inspector Chick. Two storeys, concrete foundation, brick and frame construction.

Addition to church contemplated by Queen St. East Presbyterian Church. Pastor, Rev. W. H. Andrews, 85 Simpson Ave. Seating capacity to be enlarged to 1,200.

Union, Ont.

Essex County Health Assn. contemplate purchasing hospital equipment. Regent, Mrs. C. R. Casgrain, Windsor. Equipment for tuberculosis hospital required.

Vawn, Sask.

The Board of Trustees, Treasurer, H. G. Winger, will borrow the sum of $2,500 for the purpose of purchasing site, erecting and equipping a school building.

Victoria, B.C.

Drill hall, McBridge and Bay Sts., for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Dec. 11th. Plans, specifications, etc., at office of Wm. Henderson, Post Office Bldg., Victoria, Postmaster, Victoria, and at Dept., Ottawa. Two storeys, 120 x 100.

Welland, Ont.

Addition to registry office, East Main, for Welland County. Clerk, Robt. Cooper. Chairman, W. W. Brookfield. Architect, A. E. Nicholson, St. Catharines. Also new roof on old registry office, etc. Registry office fittings required. Additional 1 storey and basement, 60 x 30, pressed brick construction, cement foundation. Plans in progress.

Westboro, Ont.

Church, cost $11,000, for Presbyterian Church. Pastor, Rev. W. H. Cram. Architect, J. P. McLaren, 104 Sparks St., Ottawa. Plastering, Bowman & Son, Ottawa, Roofing on.

Weyburn, Sask.

City and fire hall for City Council. Mayor, M. C. Taggart, City Hall. Sec.-Treas., J. D. Murray. Architect, B. O. Boyam. Work will not start until after sale of debentures. Plans drawn.

Windsor, Ont.

Addition to hospital, cost $25,000, Ouellette, contemplated for Hotel Dieu, Ouellette Ave. and Erie St. Pres., Dr. E. Prouse. Sec., Dr. W. C. Pepin. Architect not yet appointed. Two storeys, brick construction.

Winnipeg, Man.

Addition to hospital, cost $65,000, Selkirk, for Prov. Govt. of Manitoba. Minister, Hon. W. H. Montague. Prov. Architect, V. W. Horwood, 261 Fort St. General contractors, Carter, Halls & Aldinger, Union Bank Bldg. Tenders received by Architect until Nov. 19th, for electric wiring.

Church, Qu Appelle Ave., for Knox Presbyterian Church. Pastor, Dr. Du Val.. Architect, J. H. G. Russell, 1105 McArthur Bldg. General contractors, J. McDiarmid & Company, Canada Bldg. Excavating finished. Work suspended till 1914.

Yorkton, Sask.

The Board of Trustees will borrow the sum of $16,000 for the purpose of purchasing site, equipping and completing new school building.

CONTRACTS AWARDED

Montreal, Que.

Hospital, cost $35,000, Cedar Ave., for Children's Memorial Hospital, Cedar Ave. Architects, Brown & Vallance, 44 Canada Life Bldg. General contractor, C. E. Deakin, Mayor St. Contract awarded.

Regina, Sask.

Addition to hospital for City of Regina (Hospital Board). Architect, N. R. Darrach, Western Trust Bldg. General contractors, R. J. Lecky Co., Northern Crown Bank Bldg. Heating and plumbin, Regina Plumbing & Heating Co., Ltd., Hamilton St., $42,000. Contract awarded.

Garbage transfer station for City Council. Contract for roof trusses awarded to Sack & Co., $15,870.20.

Steelton, Ont.

Post office, cost $30,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, Thos. R. Wilks, 612 Queen St., Sault Ste. Marie. General contractors, Woolrich & Thornton, Sault Ste. Marie.

Toronto, Ont.

Church, cost $8,000, Glen Morris, for St. Pauls Lutheran Church. Architect, M. Klien, 46 Bellevue Place. Mason, F. & A. E. Ham, 83 Salem. Carpenter, O. S. DeForest, 67 Westmoreland Ave. Work not started. One storey, 32 x 69, brick and steel construction, brick foundation, slate roofing.

Alterations to school, Dewson, for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Mason, J. C. Bayliss Sons, 278 Gladstone Ave., $499. Ash hoist, Elevator Specialty Co., 36 Lombard St., $541.

Addition to school, Ryerson, for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Mason, A. Webb, 12 Shirley st., $13,398. Carpenter, F. Armstrong, Oak St., $11,850. Plastering, Geo. White, 688 Kingston Rd., $2,522. Painting, James Taylor, 179 Markham St., $1,150. Roofing, A. Matthews, 256 Adelaide St. W., $880. Fireproof floors, R. Bennett, Kingston Rd., $999. Iron stairs. Shipway Iron Bell & Wire Mfg. Co., King W., $1,348. Plumbing, L. Legrow, 98 Harboard St., $338.

Westboro, Ont.

Contract has been awarded to J. A. Ellacott, 226 Bank St., Ottawa, for wiring and new fixtures in the First Baptist Church.

Business Buildings and Industrial Plants

Beaconsfield, Que.

Alterations to club house, cost $55,000, planned by Beaconsfield Golf Club, R. J. Tooke, Montreal. Architects, Brown & Vallance, Can. Life Bldg., Montreal. General contractors, Atkinson, Glassco, Lawrence, Ltd., 45 St. Alexander St., Montreal. General contractor will call for tenders on plastering, plumbing, heating and electrical work, in spring. Excavations to be started.

Berlin, Ont.

Auto factory for H. Nyberg. Industrial Commissioner, Geo. Rumpel. One storey, 250 x 250. Plans drawn.

Felt hat factory, Victoria St., for Walter G. Rumpel. General contractor, J. Baetz, day labor. Three storeys, 60 x 120. Foundations in.

Wholesale grocery warehouse, Victoria, for J. Sloan & Co., Church St., Toronto. Architect, C. Knechtel. Carpenter, Geo. Bucher. Foundations in.

Brantford, Ont.

Ice manufacturing plant contemplated for Brantford Ice Co. New ice manufacturing plant to be constructed. Estimated cost, $45,000.

Caledonia, Ont.

Elevator and warehouse for The Shirra Milling Co. Arrangements are being made to have G. T. R. build switch into new premises. Plans in progress.

Calgary, Alta.

Warehouse, $150,000, for Pilkington Bros. Architects, Hodgson, Bates & Beattie, Grain Exchange. General contractors, mason, carpenter and painting, Carter, Halls & Aldinger, Burns Block. Heating and plumbing, Wm. Heab & Co., Ltd., 833 7th Ave. W. Electrical, Gracey Crane Elec. Co., 6th Ave. and 1st St. W. Brick work to start.

Stores and offices, cost $250,000, for Herald Publishing Co. Architects, Brown & Vallance, 400 Lougheed Bldg. General contractors, Fysche, McNeil, Martin & Trainer, Dominion Bank Bldg. Trimming interior.

Canada Life Bldg., for Canada Life Assurance Co. Architects, Brown & Vallance, 400 Lougheed Bldg. General contractors, Fysche, McNeil, Martin & Trainer, Dominion Bank Bldg. Interior trimming.

Creamery, cost $12,000, 3rd ave. and 5th St. W., for P. Pallesen. Architects, Laing & Smyth, 210 Beveridge Block. General contractors, Union Building Co., Judge Travis Bldg. Two storeys, brick veneer and frame construction. Foundations in. 46 x 110.

Stores, cost $5,000, 17th ave., for P. J. Crohan. Architects, Laing & Smyth, 210 Beveridge Block. One storey, 50 x 70, hollow tile construction, concrete foundation, Carey roofing. Nothing will be done till next spring, when tenders will be called.

Stores and bachelor apartments, cost $50,800, for P. O. Sullivan. Architect, J. B. Henderson, 313 Beveridge Block. General contractors, McDougall & Forster. Two storeys, 75 x 130, brick and reinforced concrete construction, cement foundation. Tenders will be called in about two weeks.

Warehouse, for Alaska Bedding Co. General contractors, Carter, Halls & Aldinger, 7th and 1st Sts. W. Completed.

Charlottetown, P.E.I.

Curling rink, cost $5,000, Grafton, for Charlottetown Curling Club. Secretary, Sydney Grey, 31 Orlebar. Architect, C. B. Chappell. Secretary will shortly call for tenders. Ice area 148 ft., three waiting rooms. 70 x 160, frame construction, pitched roof. Plans in progress.

Edmonton, Alta.

Rectory, cost $5,000, Picard, for Ruthenian Catholic Mission. Architect, A. J. McCormick, Gen. Del. Two storeys, 26 ft. 6 in. x 32 ft. 6 in., brick construction, concrete foundation, shingle roofing. Foundations started.

Alterations to building, Crystal Block. Promotor of company, Jno. Dawson, Crystal Block. Capital, $28,000. Basement of building will be altered and equipped with Turkish baths, swimming pool, etc. Work to start at once.

Store and apartment, cost $20,000, Syndicate, for Architect, E. S. McQuaid, Gariepy Block. General contractor, masonry and carpentry, Mr. Armstrong, General Delivery. Three storeys, 133 x 77½, brick construction, concrete foundation, felt and gravel roofing. Foundations started.

Store and apartments, cost $60,000, for E. S. McQuaid, Gariepy Block. General contractor and architect, McSporrin & Co., 715 2nd street. Three storeys, 100 x 66, steel and brick construction, felt and gravel roofing, electric lighting, steam heating, fir floors, wood fibre plastering, plate glass, fire escapes, store fronts and fixtures, telephone system, fire extinguishers. Foundations in.

Store contemplated at Whyte ave., for Jno. Walters, Walterdale. Store to be built on site of building recently destroyed by fire.

Goderich, Ont.

Addition to plant, cost $90,000, contemplated by American Road Machinery Co. Ratepayers will vote on Nov. 29th to guarantee bonds and give fixed assessments.

Hamilton, Ont.

Stores and apartments, cost $10,000, King street, for T. W. Hand, 584 King St. W. Architects, J. A. Armes and Walter Scott, Federal Life Bldg. Roofing, M. V. MacLean, 314 Hess St. S. Walls up.

Stores and hall, cost $25,000, Main St. E., for Royal Templars of Temperance, Spectator Bldg. Architect, W. A. Edwards, 7 Hughson St. S. Painting, Goodale & Laidlaw, Hunter St. E. Metal work, M. V. MacLean, 314 Hess St. S. Foundations in.

Kincardine, Ont.

Chopping mill. Owner and general contractor, J. W. Rea. Two storeys, 36 x 40, frame and steel siding construction, steel roofing, machinery required. Work started.

London, Ont.

Store, cost $12,000, King near Talbot, for S. E. Burridge, 99 King St. Tenders received by owner. Plans drawn. Two storeys, 50 x 80, red brick construction, concrete foundation, felt and gravel rfg.

Remodelling two stores, cost $10,000, Dundas street, contemplated for W. G. Young, jeweller, 500 Colborne street. All new furnishings required, shelving, show cases, burglar alarm, vaults, store fronts, plate glass, etc.

Midland, Ont.

Saw Mill boiler house. Dollartown. Owner and general contractor, Maniey Chew. To be in operation next spring.

46 x 44, Dutch ovens to be installed, also additional engine. Work is in progress.

Montreal, Que.

Factory, cost $5,000. Owner and general contractor, A. Chenevert, 103 Delorimier. Work done by day labor. Three storeys, 80 x 40, concrete foundation, felt and fravel roofing. Excavating.

Stores, Westmount (Victoria and Sherbrooke W.) for F. P. Buchanan, Victoria and Sherbrooke. Architect, H. E. Shorry, 56 Beaver Hall Hill. Plans will be ready shortly.

Club house, cost $30,000, Westmount for Westmount Lawn Bowling Club. Secretary, F. Fowler. Owners have decided to build a small addition to present wooden house.

Offices, St. Lawrence St. and Notre Dame E., contemplated. Interested, Mr. R. T. Leclerc, 8 St. Lawrence Blvd.

Stores, Westmount, for F. P. Buchanan, Victoria & Sherbrooke,. Architect, H. E. Shorey, 56 Beaver Hall Hill. General contractors, A. F. Byers & Co., 340 University. Excavating in progress.

Garage, cost $7,000, Westmount (Roslyn Ave.), for Geo. Rabinovitch, 107 St. James St. Architects, Saxe & Archibald, 59 Beaver Hall Hill. Masonry and carpentry, Favre & Corbeau, 12 Erie Street Roofing, Douglas Bros., 19 St. Maurice. Excavating proceeding.

Moose Jaw, Sask.

Six stores, cost $11,000, 6th and Horne Sts. Owner, R. F. Jackson, Sixth and Horne Sts. Architect, Sholto Smith, 36 Main St. One storey and basement, 125 x 65, brick, structural steel and terra cotta construction, cement foundation, B. C. fir floors, galvanized iron, felt and gravel roofing. Sketches drawn.

Newmarket, Ont.

Summer hotel contemplated for Wm. Prosser. Site has been purchased on Lake Shore.

North Buxton, Ont.

Contemplated purchase of chopping mill equipment for C. H. Shupe. Machinery to be operated by steam. All new apparatus required.

Oakville, Ont.

Planing mill contemplated by the Owners, Messrs. Davis & Doty. 45 x 100, brick construction, electric motors required.

Ottawa, Ont.

Business block, cost $145,000, Wellington street, for American Bank Note Co., Wellington St. Architect, J. Albert Ewart, 193 Sparks St. Carpentry, J. & C. Low, 262 Catherine. Walls up four stys.

Theatre, cost $40,000, Bank St., for H. Brouse, Bank St. Architect, W. Herbert George, Castle Bldg., Queen St. Brick. T. C. James, 140 Flora St. Steel, Dominion Bridge Co., Sparks St. Tenders not yet called for other trades. Foundations going on

Stores and offices, cost $50,000, Queen, for R. W. Stephens, Queen St. Architect, Jas. Mather, Wellington St. General contractors, Chas. Holbrook & Sons, 425 Somerset. Steel and brick construction, concrete foundation, waterproofed. Excavation going on.

Alterations to bank, cost $15,000, Wellington, planned by Bank of Montreal. Manager, Mr. Parker. Architect, C. P. Meredith, 126 Sparks St. Carpentry, J. G. Adamson, 126 Sparks St. Foundations in.

Harness factory and warehouse, Mosgrove, for S. & H. Borbridge, 90 Rideau St. Electrical, Rideau Electric Co., Rideau St. Walls up.

Business block, cost $100,000, Bank St., for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Carpenter, Alex. Christie, Elgin Street. Walls up six storeys.

Prince Albert, Sask.

Packing plant, $20,000, for Saskatchewan Abattoirs Ltd., North P.A. Architect, N. Luke. General contractor, masonry and carpentry, Luke Bros. One storey, 30 x 60, concrete blocks, reinforced concrete and brick veneer construction, composition paper, felt and gravel roofing, electric lighting, ventilating, concrete floors. Foundations in.

Factory, cost $120,000, contemplated by Royal Farm Machinery Co. Representative, F. L. Taylor. Company has been granted site of five acres.

Petrolia, Ont.

Remodelling store contemplated for J. W. Patterson, clothier. Architect to be selected.

Regina, Sask.

Hotel, cost $45,000, Broad St., for Geo. Broder, Winnipeg and Victoria Sts. Architect, S. J. Tripp, Princess Theatre Bldg. Tenders will not be called for other trades until early in spring, 1914. 100 bedrooms, brick and terra cotta construction. Foundations in.

Printing office, Halifax St., for Saskatchewan Courier, 104 Northern Crown Bank Bldg. Manager, F. Brewgmann. General contractors, Parsons Construction & Engineering Co., Ltd., 1712 Scarth St. Foundations in.

Machine shop contemplated for Norris & Barrett Co., Petoskey, Mich., U. S. A. for manufacture of steel tools and rough instruments of various kinds. Have applied to city for site.

Stratford, Ont.

Addition to factory for the Avon Hosiery Co., 82 Erie St. Manager W. Pearson. By-law to guarantee bonds and fixed assessment defeated. Company proposed to add four storeys, 95 x 60, to present plant.

Strathroy, Ont.

Addition to bakery, cost $5,000, contemplated for Jno. Nunn. Architect to be selected. White brick construction.

Sunnyside, Ont.

Addition to hotel, cost $5,000, for Albemy Chappus, Sunnyside. Architects, G. Jacques & Co., Windsor. Two stys., 30 x 69, concrete foundation, frame construction, shingle roofing. Plans in progress.

Saskatoon, Sask.

Stores and offices, $600,000, for J. C. Drinkle. Architects, Thompson & Crockart, Masonic Temple. General contractors, Frid Lewis Co., 637-9 Somerset Bldg., Winnipeg. Five storey addition to be added to building, being erected Work will be completed in the spring. Ten storeys and basement, 75 x 100, brick, stone, reinforced concrete, granite and hollow tile construction.

Toronto, Ont.

Factory, cost $25,000, for Lever Bros., Ltd., Eastern Ave. Architect, Geo. W. Gouinlock, Temple Bldg. Two storeys, 35 x 118, steel and brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, birch floors, lime and sand plastering, metal lath and sash, wire glass, fireproof doors. Plans drawn.

Addition to warehouse, cost $6,000, for Barrett Bros., 111 Adelaide St. W. Mason, Wickett Bros., 35 Deer Park Cres. Carpenter, E. A. Cale, 312 Wellesley. Two storeys, 20 x 38, steel and brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, concrete and birch floors, metal sash, wire glass, fireproof dors. Excavating.

Store and apartments, cost $6,000. Owner and general contractor, I. Ellenson, 211 McCaul St. Architects, Ellis & Connery, 72 Queen St. W. Three stys., 24 x 60, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, spruce, birch and oak floors, lime and sand plastering, wood lath, plate glass, built-in fireplaces, mantels. Plans drawn.

Addition to warehouse, cost $8,000, for Debenham & Co., Wellington & Bay Sts. Architect, Geo. W. Gouinlock, 1108 Temple Bldg. Mason and carpenter, Joseph Sim, 372 Markham St. Plumbing, R. Paterson, 907 Keele St. Four storeys, 20 x 80, reinforced concrete, steel and brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, birch floors, lime and sand plastering, metal lath and sash, plate and wire glass, fireproof doors. Work in progress.

Store and apartment, cost $9,000, 1996 Dundas St. Owner and general contractors, Rosenfeld Bros., 572 Annette St. Owner employs regular staff, first floor will be occupied by Dom. Knitting Mills, for manufacture of sweaters, etc., about Feb. 1st. Three storeys, 30 x 80, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, spruce and concrete floors, lime and sand plastering, wood lath, plate glass, galvanized iron, store fronts, mantels. Work in progress.

Garage, cost $7,000, 268 Summerhill Ave. Owner and general contractor, J. Nelson, 115 Jarvis St. Brick and steel construction, brick and concrete foundation, felt and gravel roofing. Work in progress.

Villeray, Que.

Store and flats, cost $8,000, St. Hubert St., for Mr. Auger, St. Hubert St. Architect, Z. Trudel, 238 St. Andre St., Montreal. Nothing further will be done till spring.

Weyburn, Sask.

The additional two storeys to the McKinnon Departmental Store will not be started at present.

Windsor, Ont.

Store and office building, cost $20,000, Pitt W., for Dr. A. J. Menard. Architects, G. Jacques & Co. Two storeys, 50 x 94, brick construction. Sketches in progress.

Winnipeg, Man.

Industrial plant is contemplated by Frys, Ltd., London, Eng. Additional information later.

Addition to office, cost $12,000, William and Ellen, planned by Public

(Continued on page 71)

Tenders and For Sale Department

WANTED

Duplex Steam Pump, Size 17 by 10 by 12. Slight variation in dimensions not detrimental.

J. L. MILLARD,
F Aylmer, Ont.

TENDERS

Sealed tenders will be received up to seven o'clock precise, **Saturday, November 29th, 1913**, for the construction of a steel bridge with concrete pillars across the Beaudette River in the Parish of St. Telesphore, Soulange, Co., P.Q.

Tenders must be accompanied by a certified cheque for 10 per cent. of the amount, and should be addressed to the Secretary-Treasurer of the Municipality of the Parish of St. Telesphore, Soulange Co., P.Q. The Council is not held to accept the lowest or any other tender.

Plans and specifications can be seen at the office of the Secretary-Treasurer.

Separate tenders can be prepared, one for the concrete pillars, and the other for the steel superstructure or for both.

JAS. ED. CHARLEBOIS,
Secretary-Treasurer.
St. Telesphore, Nov. 6, 1913. 46-48

BOARD OF EDUCATION
TORONTO

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday Noon, November 28, 1913.
for the several trades required in the

Enlargement of Strathcona School.
Enlargement of Western Avenue School.
also for
Heating and Ventilating, Plumbing, Electric Wiring and Heat Control in the following schools

REGAL ROAD PARKDALE
HUMEWOOD AVENUE
HOWARD KIMBERLEY
SHIRLEY STREET
also for
Hot Water Heating and Plumbing George Street School
and
Metal and Glass Partition St. Clair Avenue School.

Specifications may be seen, and all information obtained at the office of the Superintendent of Buildings, City Hall. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 12 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART,
Chairman of Committee.
W. C. WILKINSON,
Secretary-Treasurer.

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuses, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
47-48 Woodstock, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Renewal of South Pier at Burlington Channel, Ont.," will be received at this office until 4 p.m. on **Monday, December 15, 1913**, for the renewal of South Pier at Burlington Channel, Wentforth County, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department, at the District Engineer's office, Confederation Life Building, Toronto, Ont.; at the Post Office at Hamilton, Ont., and on application to the Postmaster at Burlington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, November 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46299. 47-48

Tenders Wanted

Tenders are required for the erection and completion of a public school on Rawdon Street, in the City of Brantford, and will be received by A. K. Bunnell, Secretary, City Hall, Brantford, up to noon on **Friday, the twenty-eighth instant.** Form of tender, plans and specifications, and further particulars to be had of Taylor & Bodley, Architects, Brantford.

Brantford, Nov. 15th, 1913. 47

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record
and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Toronto Harbor

Equipment Wanted

We are in the market for
Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment
for use on our work in

PROPOSALS WANTED

from
Experienced Contractors
for
Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to

CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

Business Buildings and Industial Plants

(Continued from page 69)

School Board. Secretary, R. H. Smith. Architect, Col. J. B. Mitchell, William and Ellen. General contractors, Worswick Bros., Hart Ave. Trimming interior.

Office, cost $173,000, Smith St., for Tribune Publishing Co. Architects, J. D. Atcheson & Co. General contractors, Hazelton & Walin, Donalda Bldg. Trimming interior.

Printing plant, McDermot and Margaretta, for Birt Printing Co., 386 Colony St. Architect, care owner. Plans drawn and work to start at once.

Addition to factory, cost $2,300, Talbot. Owners and general contractors, Bird Archer & Co., 563 Talbot St. One storey, addition, 24 x 28, stone foundation. Excavating proceeding.

CONTRACTS AWARDED

Berlin, Ont.

Theatre, cost $25,000, King West, for L. Longo, King St. W. Architect, C. Cowan, Victoria St. Electric, Rank & Ferrier, King St. W. Gallery completed, ready for seats.

Ford City, Ont.

Store and flats, cost $4,000, Drouillard, for Frank St. Louis, Windsor. Architect and general contractor, Walter Taylor, Windsor. Two storeys, 35 x 56, concrete foundation, frame construction, shingle roofing.

London, Ont.

Garage, cost $18,000, York St., for J. Hendricks, rear Gaste Cigar Factory, King St. General contractor, R. H. Smith, Wharncliffe Rd. Two storeys, 65 x 135, red and white brick construction; concrete foundation, waterproofed, asbestos roofing.

Montreal, Que.

Stores, etc., cost $750,000, St. Catherine and St. Denis, for U. H. Dandurand, St. James & St. Lawrence. Architects, Ross & MacDonald, 1 Belmont St. General contractor, C. E. Deakin, 41 Major St. Granite, Argenteuil Granite Co., 42 Craig W.

Ottawa, Ont.

A contract has been awarded by the city of Ottawa to McDonnell & Dibblee, New Birks Bldg., Montreal, for the erection of a temporary bridge at Bank St.

Alterations to hotel, Besserer, planned by Federal Hotel, Estate of Margeart Cowan. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Ferguson & Lambert, King Ed. Ave. Plastering, E. Normand, Redpath St. Painting, C. A. Ferguson. Heating and plumbing, Holloway & Son, 373 Somerset. Electric, Thos. E. Hopson, 213 Wellington. Bar room extensions, alterations and addition to lavatories, etc.

Alterations and addition to warehouse Wurtemburg, for McDougalls Ltd., 527 Sussex St. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Smith Bros., 448 McLeod. Metal work and heating, McKinley & Northwood, Rideau St.

Toronto, Ont.

Alterations to factory, cost $5,500, Don Roadway, for Lever Bros., Eastern Ave. Architect, Geo. Gouinlock, Temple Bldg. General contractors, T. Cannon & Son, 75 Brock Ave. Iron tanks, J. Inglis & Co., Strachan ave. Concrete foundation, brick construction, foundation for iron tanks.

Windsor, Ont.

Store, cost $25,000, Wyandotte, for G. Kahn, Windsor. Architects, Watt & Blackwell, London, Ont. Masonry, Geo. Goodman, Windsor. Carpentry, Victor Williamston. Two storeys, 55 x 60, brick foundation, reinforced concrete and brick construction.

Residences

Calgary, Alta.

Residence, cost $50,000, for Dr. N. J. Lindsay, 503 Centre St. Architects, Hubble & Kelly, Oddfellows Block. Two storeys and basement, cut stone and brick construction, one electric elevator. Work will be discontinued until next year.

Dartmouth, N.S.

Residence, cost $9,000, for W. H. Covert, K.C., care Covert & Pearson, 45 Sackville St., Halifax. Builder and general contractors, Thomson & Theakston, 100 Hollis St., Halifax. Sub-contracts not yet let. 2 ½storeys, 40 x 60, frame construction, shingle roofing. Foundations in.

Edmonton, Alta.

Residence, cost $5,000, for M. Price, architect and general contractor, 1822 26th St. 2½ storeys, 22 x 28, frame construction, brick foundation, shingle roofing, electric lighting, hot air heating, maple floors, wood fibre plastering, one built-in fireplace. Foundations started.

Eight residences, cost $8,000, for Alberta Lumber Co., architects and general contractors, Muskoka Ave. One storeys, 16 x 24, frame construction, brick foundation, shingle roofing, electric lighting, stove heating, fir floors, wood lath plastering. Walls up.

Exeter, Ont.

Four residences contemplated, cost $8,000, for C. B. Snell. Architect to be selected. 1½ storeys, brick foundation, frame and white brick construction, shingle roofing, maple and pine floors, lime and sand plaster, plumbing.

Hamilton, Ont.

Two residences, cost $6,000. Owner and general contractors, MacKay Bros., Lister Chambers. 2½ storeys, brick construction, stone and concrete foundation, shingle roofing, gas and electric lighting, hot water heating, maple floors, mantels, plumbing. Permit issued.

Six residences, cost $11,000. Owner & general contractor, M. Levy, Lister Chambers. Plumbing, Clyde Plumbing Co., York St. 2½ storeys, brick construction, concrete foundation, shingle roofing, hot air heating, pine floors, plumbing, electric lighting. Permit issued.

London, Ont.

Apartment house, cost $25,000, for R. Y. Stinchombe, Wharncliffe Rd, West London. Architect to be selected. Brick construction, gas and electric lighting, hot water heating, fireproof, maple and concrete floors, plumbing, lime and sand plastering.

Montreal, Que.

Six flats, cost $5,500. Owner, F. X. Poirier, 2257 Notre Dame W. Foundation ready. Work to go ahead in spring.

Three storeys, 39 x 59, concrete foundation, felt and gravel roofing. Foundations in.

Six flats, cost $6,000. Owner and general contractors, Beaudin & Frere, 40 Walker. Three storeys, 38 x 63, concrete foundation, felt and gravel roofing. Excavating.

Residence, cost $8,000, for J. W. Brown, 65 Summerhill Ave. General contractors, Archambault & Conway, 332 Bleury St. General contractor wishes more tenders for heating, plumbing and electric. To close about Nov. 15th. Roof on.

Two residences, cost $10,000, for Anglins Ltd., 65 Victoria. Three storeys, 48 x 36, concrete foundation, felt and gravel roofing. Excavating done.

Apartment house, cost $20,000, for Mr. Joly, St. Viateur W. Architect, Z. Trudel, 238 St. Andre St. Plans are being changed for apartment house. Architect will be ready in a couple of weeks to call for new tenders.

Apartments, cost $8,000. Owners and general contractors, Hand & Pick, Belmont Ave. One storey, 58 x 73, concrete foundation, felt and gravel roofing, fireproof construction. Foundations in.

Residence, cost $7,000, Outremont (Querbes Ave.) Owner and general contractor, David Abel, 2156 St. Urbain St. Two storeys, 25 x 50, concrete foundation, pressed brick construction, felt and gravel roofing, gas and electric lighting, plate glass, hot water heating, hardwood floors, lime and sand plaster. Foundations going on.

Two residences, cost $16,000. Owner and general contractor, Geo. E. Blackwell, 4184 St. Catherine W. General contractor ready to receive tenders for roofing and electric. Contracts to be given shortly. Foundations going in.

Montreal West, Que.

Residence, cost $6,000, for G. E. Templeman. Architects, Peden & McLaren, St. Alexis St. General contractor, H. Payne. Concrete foundation, encased brick construction, slate roofing, gas and electric lighting, hot water heating, hardwood floors, lime and sand plaster, built-in fireplaces. Excavating.

Residence, cost $5,500, for A. Sampson, Canadian Fairbanks Morse Co., St. James. General contractors, Montreal West Realty & Contracting Co. General contractors doing all trades. Foundations in.

Residence, cost $5,000, for E. B. Barley, Westminster Ave. General contractors, Montreal W. Realty & Contracting Company. Walls up.

Residence, cost $10,000, Owners and general contractors, Montreal West Realty & Contracting Co. Brick construction. Foundations in.

Flats, cost $15,000, for J. A. Duval, 1701 St. Lawrence St. Architect, Z. Trudel, 238 St. Andre St. Three storeys, 90 x 25. Foundations in.

Ottawa, Ont.

Residence, cost $6.000. Owner, architect and general contractor, J. D. Wilson, 17 Clarey St. Brick construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch floors, water heaters, built-in fireplaces, mantels. Excavating.

Residence, cost $6.600, for S. J. Willoughby, 101 James St. Architect and general contractor, R. E. McKinstrey, 91

2nd Ave. Brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, oak and birch floors, water heaters, lime and sand plastering, built-in fireplaces, mantels. Excavating.

Residence, cost $6,000, for J. C. Reynolds, 117 Henderson Ave. General contractor, R. W. Hamilton, 81 Echo Drive. Double brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch floors, water heaters, built-in fireplaces, mantels. Excavating.

Residence, cost $6,000, contemplated by J. D. Wilson, 17 Clarey St. 2½ storeys, brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch and spruce floors, water heaters, built-in fireplaces, mantels.

Residence, cost $5,000. Owner and general contractor, Robert Edmondson 63 Blackburn. Stone foundation, double brick veneer construction, shingle roofing, electric lighting, hot air heating, water heaters, birch floors, built-in fireplaces, mantels. Excavating.

Residence, cost $8,000, for Col. Sherwood, Daly Ave. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Ferguson & Lambert, King Edward St. Plastering not yet awarded. Walls up.

Residence, cost $6,000, for M. C. Odell, 335 Somerset St. E. Stone foundation, brick veneer construction, shingle roofing, electric lighting, hot water heating, birch and spruce floors.

Residence, cost $5,500, for Geo. E. Preston, 280 Elgin St. Architect, C. J. Burritt, 193 Sparks St. General contractor, R. W. Hamilton, 81 Echo Drive. Electrical, T. E. Hopson, 213 Wellington S. Walls up.

Quebec, Que.

Alterations to residence, cost $7,000, for Mrs. Luce Couture, cor. St. Joseph and St. Anselme. General contractor and mason, A. Deslauriers, 400 St. Francis. Two walls to be demolished and rebuilt. Three storeys, 44 x 33, Scotch brick construction, felt and gravel roofing.

Qu'Appelle, Sask.

Residence, cost $5,000, for Jas. Caswell. 2½ storeys, brick and frame construction, shingle roofing, hot air heating. Foundations in.

Regina, Sask.

A five-storey apartment block, cost $30,000, is contemplated by A. M. Fields, care W. A. Burns, New Dallas Block.

Stanbridge East, Que.

Residence, cost $25,000, for C. S. Campbell, Merchants Bank Bldg., Montreal. General contractors, Laurentian Construction Co., 10 St. Francois Xavier St., Montreal. Roof on.

Toronto, Ont.

One pair residences, cost $5,500, Bertmount. Owner and general contractor, G. L. Robinson, 107 Armstrong. Owner will sublet. 2½ storeys, 38 x 40, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Three pair residences, cost $10,000. Owner and general contractor, A. Kemp, 108 Edgewood Ave. 2½ storeys, 36 x 40, brick and roughcast construction, brick foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels. Plans drawn.

Six apartment residences, cost $15,000. Owner and general contractor, G. Phillip, 556 Huron St. Owner superintends construction. Two storeys, 90 x 60, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, spruce and oak floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Two residences, for S. Fried, 265 Maria Ave. Two storeys, 22 x 42, brick construction and foundations, slate roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, mantels. Owner wishes prices on plumbing and heating.

One detached residence, cost $9,500. Architect, S. B. Coon & Son, 512 Temple Bldg. 2½ storeys, 30 x 44, stone foundation, stone and brick construction, slate roofing, oak and birch floors, gas and electric lighting, hot water heating, lime and sand and ornamental plastering, wood lath, marble tiling, art glass, galvanized iron, mantels, built-in fireplaces. Tenders received by architect until Nov. 20th.

Residence, cost $15,000, for C. J. Read (in trust), architect, Confederation Life Bldg. Contracts let by architect. 2½ storeys, 20 x 43, brick construction, stone and brick foundations, slate roofing, gas and electric lighting, hot water heating, oak and maple floors, hard wall, lime and sand plastering, built-in fireplaces, mantels. Plans drawn.

One detached residence, cost $5,000. Owner and general contractor, C. J. Doughty, 4 Playter Blvd., who will supervise. Will let roofing, plastering, painting, plumbing and electric. 2½ storeys, 22 x 43, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

One detached residence, cost $6,000, for J. H. Keens, 174 Spadina Ave. Architect, H. G. Salisbury, 10 Adelaide St. E. General contractor, D. A. Peacock, 577 Church St. 2½ storeys, 25 x 36, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Work in progress.

Two detached residences, cost $8,500, for Frank Taylor, 162 Delaware Avenue. 2½ storeys, 23 x 36, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot water heating, oak and birch floors, lime and sand plastering, built-in fireplaces, mantels. Excavating.

Two detached residences, cost $6,000. Owner and general contractor, Building & Construction Co., 26 King St. W. Architects, Designing & Draughting Co., 36 Toronto St. No work sublet. Two stys., 27 x 36, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, spruce and birch floors, lime and sand plastering, built-in fireplaces, mantels. Plans drawn.

Three pair residences, cost $11,000. Owner and general contractor, A. A. Barthelmes, 373 Keele St. Architect, J. J. Miller, 23 Perth Ave. Two storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Residence, cost $8,000, for Dr. F. Winnett, 525 Sherbourne. Architect, Eden Smith & Sons, 199 Yonge St. Three storeys, brick construction, brick foundation, slate, felt and gravel roofing, gas and electric lighting, hot water heating, oak, spruce and concrete floors, lime and sand plastering, plate and leaded glass, galvanized iron, mantels, built-in fireplaces, refrigerators. Work started.

One pair and one detached residence, cost $9,000, for Mrs. M. Cohen, 215 Dupont St. General contractor, C. J. Cudmore, 46 Pacific Ave. 2½ storeys, 20 x 42, each, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot water heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Work in progress.

One pair residences, cost $5,000. Owner and general contractor, A. G. Chambers, 9 Withrow Ave. 2½ storeys, 36 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces Plans drawn.

Two pair residences, cost $12,000. Owner and general contractors, Anglins Ltd., 507 Lumsden Bldg. Work by day labor. 2½ storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels. built-in fireplaces. Plans drawn.

Westboro, Ont.

Residence, cost $6,000, for J. E. Caldwell, City View. Architect, C. P. Meredith, 126 Sparks St., Ottawa. Plastering, Lethbridge Bros., Ottawa. Heating and plumbing, M. M. O'Connell, Gloucester St., Ottawa. Electric, H. B. Parks, 205 Laurier W., Ottawa. Walls up.

Windsor, Ont.

Alterations to four-family flat, cost $5,000, for Geo. S. Murray, Fire Chief. Architect, G. Jacques & Co. Oak floors, electric lighting, hot water heating. Plans in progress.

Apartment house, cost $30,000, for D. M. Eagle, 18 Elliott St. Architects, G. Jacques & Co. Masonry, steel and roofing, Geo. Sewell. Carpentry and painting, Thos. Thorne. Plastering, Frank Phillips. Heating and plumbing, Joseph L'Heureaux. Three storeys, 82 x 63. Foundations in.

Residence, cost $20,000. Owner and architect, Eugene Baby, care W. J. McKee Lumber Co. Two storeys, 26 x 24, concrete foundation, frame construction, shingle roofing, gas lighting, stove heating, maple and pine floors, lime and sand plastering.

Three-family terrace contemplated, cost $8,000, for Edward Glasgow. Architects, G. Jacques & Co. Two storeys, 34 x 60. brick construction.

Winnipeg, Man.

Four residences, cost $8,000, for O. Bjarnason, 726 Simcoe. Two storeys, 21

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x 36, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

Two residences, cost $5,000. Owner and general contractor, J. T. Watson, 58 Sherbrooke. Two storeys, 21 x 32, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

Three residences, cost $7,500. Owner and general contractors, Pschaida & Hess, 554 Mountain Ave. Two storeys, 20 x 26, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors.

Three residences, cost $6,900, for G. Storeseter, 354 Simcoe. Two storeys, 18 x 26, frame construction, stone foundation, shingle roofing, hot air heating, maple and pine floors, Excavating.

Two residences, cost $5,000, for B. Brown, 473 Stella. Two storeys, 24 x 26, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

CONTRACTS AWARDED

Montreal, Que.

Residence, cost $23,000, for J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. (architect changed). Foundation, masonry, and carpentry, A. K. Hutchison, New Birks Bldg. Architect to call for all other trades next week.

Residence, cost $14,000. Owner, Dr. Bournival, 387 Wiseman Ave. Architect, Charles Bernier, 70 St. James Ave. General contractor, J. B. Bisson, 811 Marechal Ave. Two storeys, 42 x 65, stone foundation, brick construction, felt and gravel roofing, electric lighting, hot water heating, hardwood floors, lime and sand plaster.

Ottawa, Ont.

Two residences, cost $8,000. Owner, Frank Williams, 207 Riverdale Ave. General contractor, Walter Fryer, 5 Glen Ave. Two storeys, brick veneer construction, stone foundation, shingle roofing, electric lighting, hot air heating, birch and pine floors, water heaters, built-in fireplaces

Toronto, Ont.

One detached residence, cost $7,000, for W. H. Baker. Architects, Chadwick & Beckett, 18 Toronto St. General contractors, Harmon & Son, 156 Dupont St. 2½ storeys, 25 x 38, brick construction, brick foundation, shingle roofing, gas and electric lighting, hot water heating, pine and oak floors, lime and sand plastering, wood lath, marble tiling, leaded glass, built-in fireplaces, mantels.

Two pair residences, cost $10,000, for T. G. Smart, care general contractor and carpenter, D. Muirhead, 52 Amelia, who will sublet plastering, painting, heating, plumbing and electric. 2½ storeys, 30 x 42, brick construction, brick foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, time and sand plastering, wood lath, built-in fireplaces, mantels.

Two detached residences, $6,000, for F. Woods, 158 Fairview Ave. General contractor, masonry and carpentry, E. Post, 210 Fairview. 2½ storeys, 24 x 36, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels.

Power Plants, Electricity and Telephones

Aurora, Ont.

Electric pump and apparatus required by Town Council. Clerk, S. H. Lundy, General contractors, The Allis Chalmers Co., 212 King St. W., Toronto, $6,695.

Amherstburg, Ont.

Transmission machinery required for Essex County Light Company's power house. Manager, R. S. Stewart. Engineer, Mr. Gunson. One storey, 26 x 30, concrete foundation, white brick construction, electric lighting steam heating, maple and concrete floors.

Calgary, Alta.

The City Council are calling for tenders which will be received by City Commissioners until Nov. 19th, for year's supply of polyphase and single phase integrating watt hour service meters (induction type). Specifications, etc., at office of Engineer, R. A. Brown, City Hall.

Lambeth, Ont.

Village Council contemplate installing Hydro system. Clerk, T. Hamlyn. Further information from Jas. Kelly.

Oshawa, Ont.

Fire alarm system contemplated by Town Council. Acting Town Clerk, F. C. Hare. System to be installed at once. Further information from Clerk.

Peterboro, Ont.

Tenders are being called for steam and hot water heating system. General contractor, Thos. C. Epgrave, 615 Union St. Plans, etc., with general contractor or Jas. R. Bell, Hunter St.

Prince Albert, Sask.

Steam power house and plant, cost $275,000, planned by City Council. Clerk, O. Davidson. Nothing will be done till next year.

Steveston, B.C.

Cold storage plant and warehouse, Lulu Island, for Columbia Cold Storage Co., 702 Front St., New Westminster. Plans prepared.

Winnipeg, Man.

The City Council, Secretary, M. Peterson, Clerk, C. J. Brown, contemplate installing ornamental street lights on both sides of Market Ave.

Welland, Ont.

Electric Steel & Metal Company's steel plant, cost $35,000. Architect, David Carnegie, London, Eng. Contracts to be let in about a couple of weeks. Four buildings, brick, structural steel and iron construction.

Yarmouth, N.S.

Pumping plant, cost $3,340. Plans and estimates have been submitted for a pumping plant at Lake George, distance of 12 miles, by the Canadian Allis-Chalmers, Ltd., Montreal. Council, Mayor, S. C. Hood, has decided to install plant provided the Electric Light Company will guarantee sufficient power to run the pumps continuously, also that the Allis-Chalmers Co. will guarantee their pumps to supply 700 gals. per minute.

Yorkton, Sask.

Diesel electric machinery planned by Town Council. Sec.-treas., T. F. Acheson. Electrical engineer, M. M. Inglis. Tenders received by secretary till 12 o'clock, Dec. 22nd, 1913, for the supply and delivery of one 500 B.h.p. combined unit. Specifications at office of engineer.

CONTRACTS AWARDED

Toronto, Ont.

Stop valves, cost $7,135, required by Board of Control. General contractors, Drummond McCall & Co., 373 Front E. 12 36-in. valves at $510 each; 7 20-in. valves at $145 each.

Winnipeg, Man.

Electric fixtures required by Board of Control. Engineer, F. A. Cambridge, City Electrician. General contractors, The Elec. Shop, Boyd Bldg., for sections "A" and "B," at $2,339.35. General contractors, The Winnipeg Brass & Fixture Co., Portage Ave. and Clifton St., for section "C," at $811.25. Fixtures for the King George Isolation Hospital.

Miscellaneous

Cowansville, Que.

Stable and barn with threshing machine and farm implements of R. E. Ruiter destroyed by fire.

Montreal, Que.

Residence of J. A. Champagne, 151 Dufresne St., destroyed by fire. Loss $10,000.

Paint shop of Dom. Iron Bound Box Co., Levis and Notre Dame, destroyed by fire. Loss $3,000.

Nipigon, Ont.

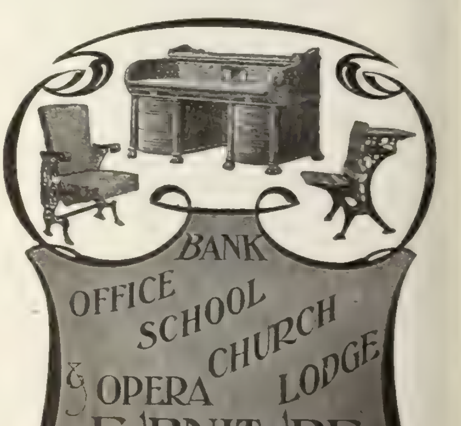
Stores, residences, etc., destroyed by fire. Owners, Enser & Dowler Block, M. Nitkin, clothier; Atwill Block, bakery, pool-room and residence; Salo Block, D. Iosenthal, clothier; M. Nitkin, barber shop; J. Goodridge, restaurant; J. Fournier, barber shop; Wm. McKirdy, general store and residence.

Oakville, Ont.

Owners, Appleby College. Barn, stable and gymnasium equipment destroyed by fire, loss $35,000.

Qu'Appelle, Sask.

Two barns destroyed by fire, loss $8,000. Owners, W. J. Craig, W. L. Waits.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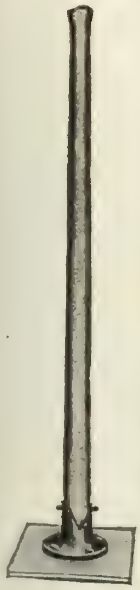
Concrete Tampers
for all kinds of concrete work



Made with strong cast iron bases in following sizes:

6" x 6"—8" x 8"—10" x 10"

and can be supplied with wood or gas pipe handles.

Our prices are lower than can be procured elsewhere and we can supply them in lots of one dozen or by the carload.

Made in correct shapes and are strong and durable.

Let us quote you prices.

Canadian-Warren Axe & Tool Co.
St. Catharines, Ont. Limited

A STEAM SEPARATOR

of the receiver type is a difficult piece of plate work to make absolutely and permanently tight. That is the reason why we developed our Welded Separator—not a single rivet in its construction, every joint and seam being a perfect weld. The shell is lap welded, the heads are set in by our patented Line Weld method and the necks are attached by our patented Interlock method.

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PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION CO.
PITTSBURGH, PA.
ENGINEERS FOUNDERS MACHINISTS
ATWOOD

Block Stone, Dimensions, Random, Head Sills, Shoddy, Stone Sawing

Sackville Freestone Co., Limited, Sackville, N. B.

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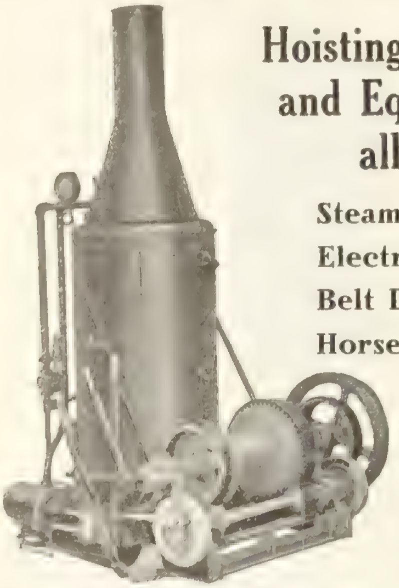


10 H. P. Reversible Builders' Hoist, supplied in seven sizes up to 50 H. P. Reversing or non-reversing.

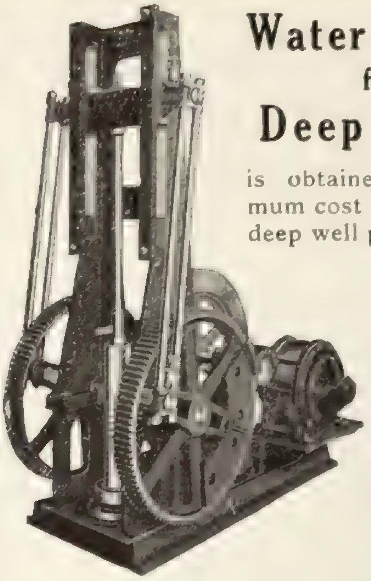
Hoisting Machinery and Equipment of all kinds

Steam Hoists
Electric Hoists
Belt Driven Hoists
Horse Power Hoists

Hand Power Hoists
and
Derrick Irons
to suit any requirements.

Steel Cars, Skips, Buckets, etc. to order.
Steel work of all kinds a specialty.

Marsh & Henthorn, Limited
BELLEVILLE, ONT.
Makers Hoisting Machinery
Sales Agents: MUSSENS, LTD., MONTREAL



Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.

Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer

A. D. COOK
Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

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Office of Dominion Iron & Steel Co., Ltd. Built of Sydney Pressed Brick

IN this product you get a brick of such superior quality that a saving of one dollar a thousand can be effected in the laying of the bricks as compared with ordinary irregular brick.

The mortar adheres with great strength to "Sydney" pressed brick and they harden with age.

Prices and Particulars on request.

Sydney Pressed Brick Co.
Limited
Sydney, Nova Scotia

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THE ONLY SYSTEM THAT HAS STOOD THE TEST OF YEARS IN THE SANITARY AND ECONOMICAL DISPOSAL OF REFUSE

DECARIE INCINERATOR CO
MINNEAPOLIS MINNESOTA

This Clam-Shell Dredge for Sale

W. Fraser
706 Power Building, Montreal

Pioneer Manufacturer of

Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.

The benefit of 20 years' experience as successful contractors.

Yours for the Asking

Hotchkiss Lock Metal Form Co.
BINGHAMPTON, N.Y.

Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs.

Careful attention to details and thorough workmanship have made Meadows' stair work popular.

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Toronto Wire, Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.

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It is easy to obtain with our plants and apparatus

We design and contract for complete municipal filtration plants of any capacity.

We supply and install apparatus for sterilizing water supplies by the application of calcium hypochlorite.

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1001 Chestnut St., PHILADELPHIA, Pa.

We have no affiliations or working acquirements with any of our competitors.

THIS IS THE SECOND OF A SERIES OF DISCUSSIONS OF SIX VITAL POINTS DETERMINING THE SELECTION OF AN

AIR COMPRESSOR

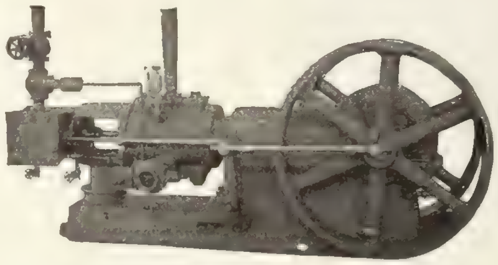
A COMPRESSOR WITH LARGE CAPACITY IN SMALL SPACE IS WHAT THE AVERAGE USER OF COMPRESSED AIR NEEDS

CAPACITY

The tendency is always to underestimate the compressed air needs, and you hesitate to buy a compressor with a margin of capacity for future requirements, because heretofore large capacity has meant a big machine, large floor space and a heavy price.

Our Class "NE" and "NF" Compressors remove this obstacle to the general use of compressed air. For they have a larger capacity per unit of space than any other small compressors.

This comes from giving them a higher rated normal speed than was ever before considered safe or practical. But—*don't make the mistake of believing that any compressor can be speeded up to give any capacity. Many so-called high-speed compressors on the market to-day are simply low-speed machines speeded up for selling purposes, beyond the limit of economy and safety.*



Class "NF-1" Convertible Steam or Belt Driven Compressor. Note position of Steam Cylinder.

A high-speed large-capacity compressor must be designed for high-speed from the foundation up—heavy construction, large bearings, copious lubrication, large valve and port areas, thorough cooling. *For you want a compressor which will not only be large in capacity and high in efficiency at the outset, but which will maintain its capacity and efficiency indefinitely.*

Our Class "NE" and "NF" compressors are designed and built for permanent, high-speed, high-economy service. The explanation lies in their heavy structure, superior materials, bath lubrication, large air passages, high class valve movements and complete cylinder jacketing.

Their regulating devices permit efficient operation at partial loads, the machines automatically taking up their burden, as the uses of air increase, up to the limit of their large capacity.

And, as explained in the previous article, these compact, high-speed, high-duty compressors can be had at a very moderate price.

CANADIAN INGERSOLL-RAND CO.,
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COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: Sherbrooke, Que.

Sydney Montreal Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

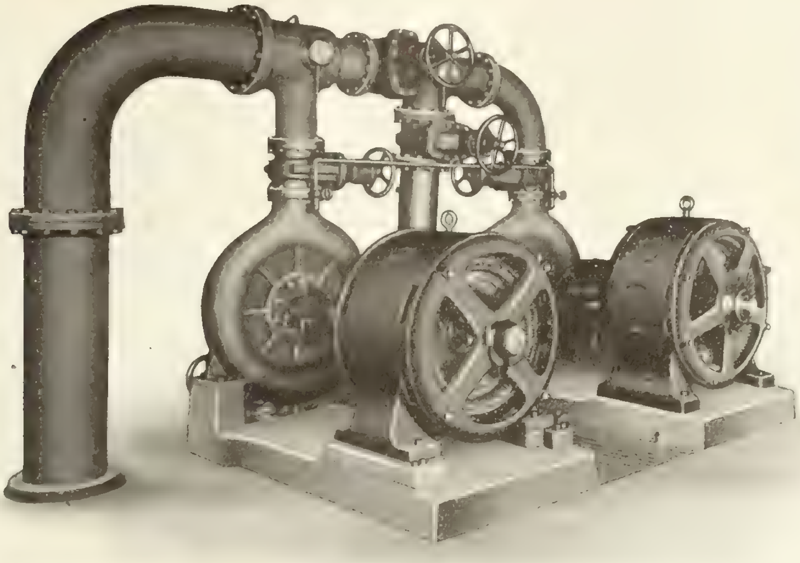
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

The Roof that Never Fails is the Roof of *Asbestoslate*

Armory, University Ave., Toronto
Roofed with Asbestoslate.

Other roofings are sold on the understanding that they may last five, ten, fifteen or even twenty years—but that all this time they will be steadily deteriorating, until at last, reaching their limit, they fail.

Not so with ASBESTOSLATE.

Instead of deteriorating, it actually becomes harder, tougher and more enduring with age and exposure. An ASBESTOSLATE roof 25 years old has just as long an "expectation of life" as has one newly laid.

No building can be too good for a roof of ASBESTOSLATE, for besides being practically everlasting, it is absolutely fireproof and decidedly artistic. Yet it costs less than natural slate or tile, and but little more than those roofings which must be frequently renewed.

ASBESTOSLATE is made in "shingles" of various sizes and shapes, in Newport Grey, Indian Red and Blue Black. Write for Booklet C.R. giving full information, to

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Chicago Bridge & Iron Works

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We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Buildings and Structural Material.

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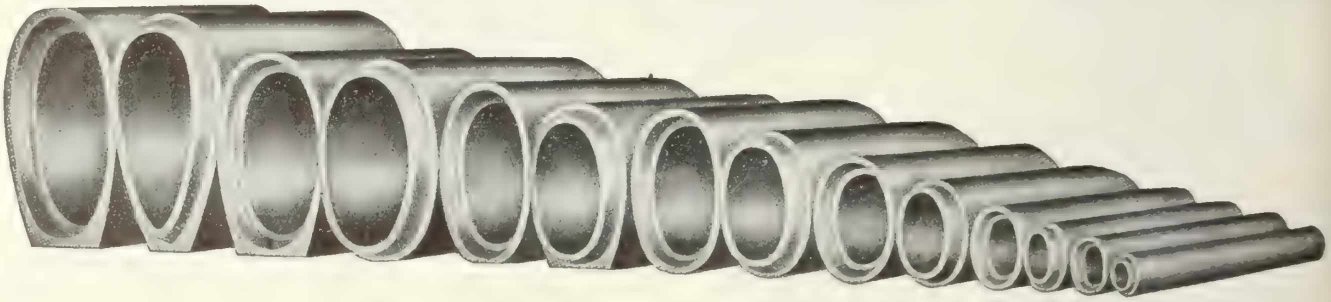

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properly built of properly made

- Reinforced Concrete Pipe -

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

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Catalogue and prices on application.

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar.. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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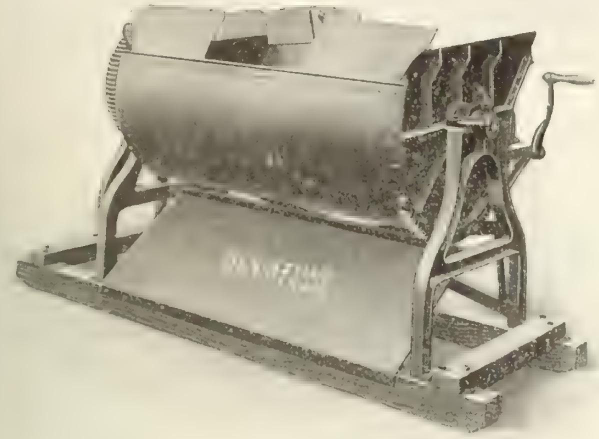

The Blystone Skid Mixer

Every movement of this mixer is calculated to save time. The mixing is quick and thorough and the dumping, worked by the handle on the right will save moments at every batch turned out. Strongly built—all working parts carefully balanced.

The Blystone Machinery Company

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"Metallic"

Siding

is made from painted or galvanized steel sheets, embossed on our modern machines. It is quickly applied to old or new wooden buildings, making them weather-proof, warm and dry; and preventing fire loss.

You can safely stock a quantity of our popular designs of siding, or have us help you estimate on local buildings for your customers. Our facilities assure you of prompt service and first-class materials and a finished job you'll be proud of.

THE METALLIC ROOFING CO.
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Contractors' Acetylene Flare Lights

Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

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1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

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Manufactured by

International Marine Signal Co. Limited
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FOR SALE

1, 10 x 16 Slidevalve Engine
2, 40 H. P. Tubular Boilers
1, 10 Ton Derrick Complete
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1, 40 H. P. Bullock Motor
2, 2 H. P. 2 Phase Motors
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1, 1/2 Yard Milwaukee Concrete Mixer
1, 7 x 10 Blake-Marsden Crusher
1, Pair 5 Foot Edge Rolls
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1, 6 x 3 x 7 Cameron Sinker
1, Buckeye Trench Excavator

The above machines are but slightly used and are in good working order.

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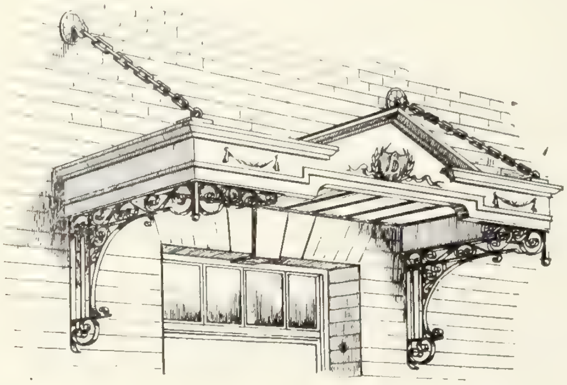

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for all types of large buildings such as factories, office buildings and warehouses.

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Absolutely the best in the city.
Daily capacity of plant: 40,000.
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Free from bats and culls.
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LOOK FOR THE STOCK MARK
Telephone or write for samples and quotations.

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GYPSUM HOLLOW TILE

The New Modern Method of Fireproofing

Very Light,
Easy to Install,
Holds nails, screws, etc.
Best non-conductor of heat,
Costs less than clay hollow tile,
Sound Proof.

Send for Catalogue and Price.

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Telephone M 6088

Screened Sand and Gravel

Prompt Shipment

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Night and Sunday calls, Phone Junction, 3333.

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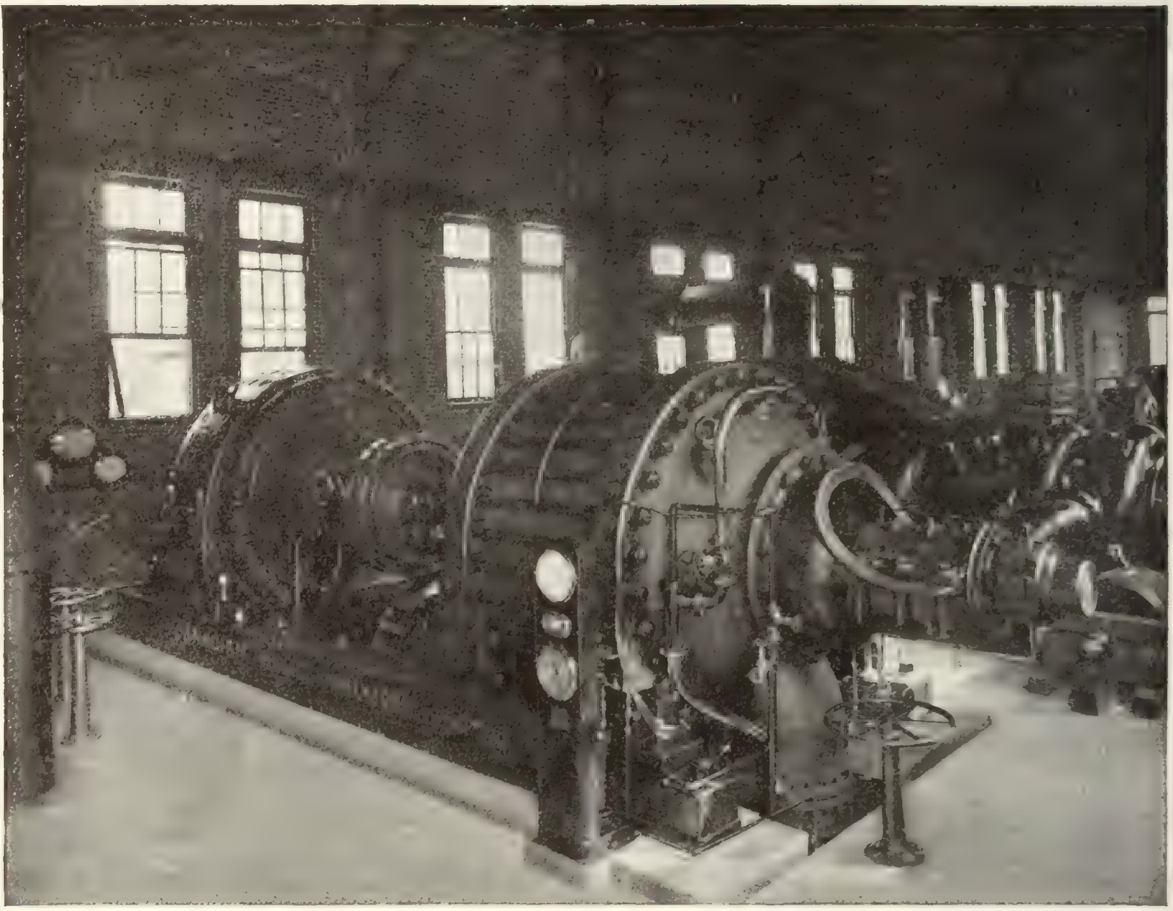
HIGH LIFT TURBINE PUMPS

Designed and Built specially to suit conditions of operation



Montreal Water and Power Co.

In the foreground is shown a Mather and Platt high lift turbine pump one of the largest in the world. It is 28″ three stage with a capacity of 10,420 imp. g. p. m. against 416 ft. head at 469 r.p.m. This pump is driven by an 1800 h.p. induction motor and in the background is shown another similar pump driven by a steam turbine.

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Head Office: KING AND SIMCOE STS., TORONTO

DISTRICT SALES OFFICES:

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The ATHEY Cloth-lined Metal Weather Strip

THE only one that keeps out all draughts and dirt.

THE only one with a cloth-lined channel in the sash.

Installed by

The EBERHARD & WOOD Mfg. Co.

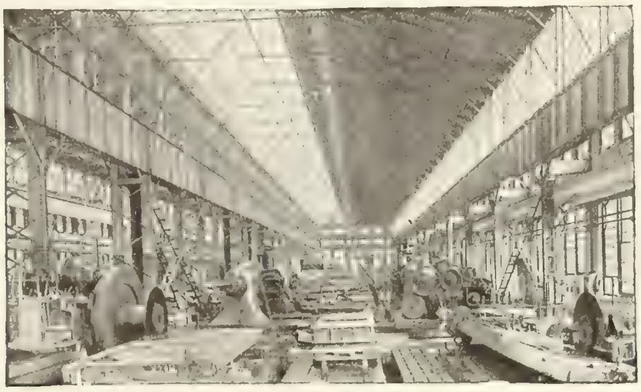
Ornamental and General Iron Works

36-38 Lombard St. Phone Main 6338 TORONTO

N.B. Can be installed on Steel Casements of any type.

Sturtevant
(REG. U. S. PAT. OFF.)

Heating Apparatus in the



Ordnance Shop No. 4 of the Midvale Steel Co., Nicetown, Penn.

This shop has a content of about 5,250,000 cu. ft. It is heated by four apparatus, one in each corner of the building. Each apparatus consists of an 8 x 4 Sturtevant fan driven by 8 x 12 Sturtevant Steam Engine. Each fan operates in connection with Sturtevant Pipe Coil Heater arranged for Exhaust Steam.

The fans discharge the heated air into the galvanized iron duct which runs entirely around the inside walls and delivers the air at intervals through short discharge pipes.

The building is heated to 65 degrees F. in zero weather, and the air is completely changed every thirty minutes.

The Sturtevant Heating and Ventilating System is positive in action, combines ventilating with heating, costs less to operate, and does away with troubles from scattered piping.

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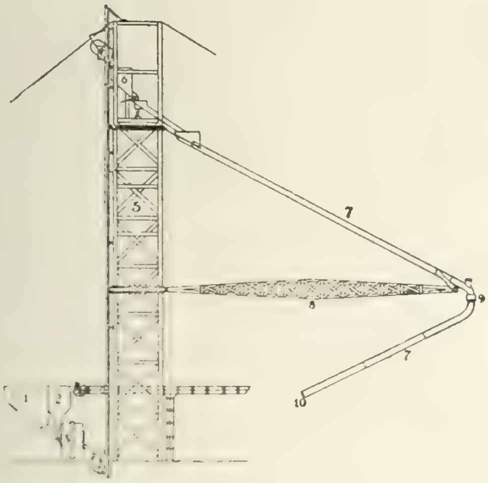
B. F. Sturtevant Co. of Canada, Limited, Galt, Ont.

Sales Office for Eastern Canada—919 New Birks Bldg., Montreal



Gravity System Distributing Concrete

A system that improves the concrete and reduces the cost.

Information gladly furnished and Estimates given on any work.

Canadian Concrete Appliance Co. Limited

Sole Licensees for Canada

613 Vancouver Block, VANCOUVER, B. C.

Eastern Representatives—

STINSON REEB BUILDERS' SUPPLY CO., LTD., MONTREAL, P.Q.

THIS CAR LOADED WITH
BAY STATE BRICK & CEMENT COATING
FOR THE
WAITE FULLERTON CO. LIMITED
WINNIPEG MANITOBA — CALGARY ALBERTA
MADE BY
WADSWORTH HOWLAND & CO INC
BOSTON MASS

A Carload of

Bay State Brick and Cement Coating

going to Winnipeg, Manitoba

Thousands and thousands of gallons of this coating are being used as a protection for cement, brick and stucco in the Canadian Northwest.

It insures concrete, cement and stucco against disintegration from moisture and does not destroy the pleasing effect of concrete.

It is used in mills, hotels, residences, railroad construction, or bridges, or wherever concrete, cement or stucco is employed.

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WOODEN WATER PIPE

For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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Works: ALEXANDRIA, ONT.

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Successors to

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Bridges—Steel Buildings
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Structural Steel Work
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Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, **New Glasgow, N. S.**

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Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

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Phones: Adelaide 1947-1948

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THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.

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Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

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The Canada Iron Corporation, Limited

Head Office:
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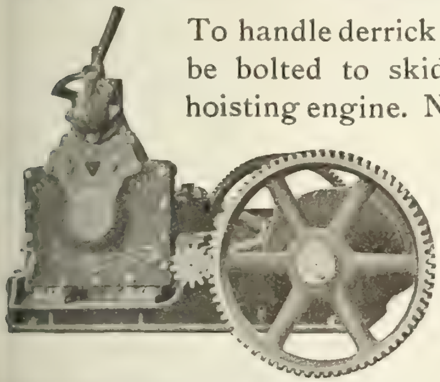
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The Dake Swinging Gear



To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

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Send us your specifications for Cut Stone work

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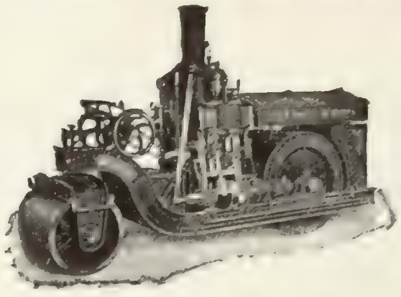

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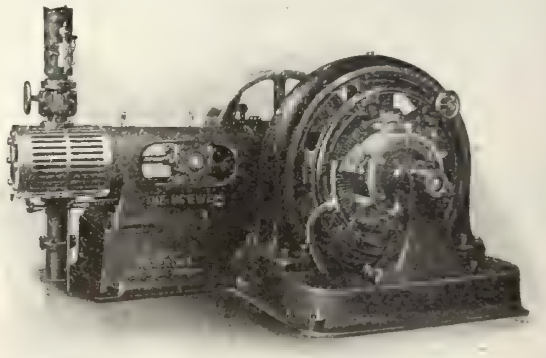
are sold on a basis of quality — of economical and efficient **initial** performance that is maintained year after year.

Every dollar put into the cost of your McEwen you get out in continuous satisfactory reliable service. They improve with use.

All sizes—simple and compound—up to 700 H.P. The McEwen booklet will interest you.



The Waterous Engine Works Co.
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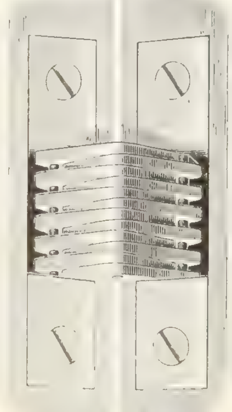
Brantford, Canada



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Toronto Safe Works

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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 “	4 60	6 75
41 to 50 “	5 10	7 50
51 to 60 “	5 35	8 50
61 to 70 “	5 75	9 75
71 to 80 “	6 25	11 00
81 to 85 “	7 00	12 50
86 to 90 “		15 00
91 to 95 “		17 50
96 to 100 “		20 50
101 to 105 “		24 00
106 to 110 “		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ “	2.16	⅜ “	3.06
½ “	2.72	½ “	3.57
¾ “	3.11	¾ “	4.26
1 “	4.59	1 “	6.29
1¼ “	6.21	1¼ “	8.51
1½ “	7.43	1½ “	10.18
2 “	9.99	2 “	13.19
2½ “	16.38	2½ “	22.23
3 “	21.43	3 “	29.70

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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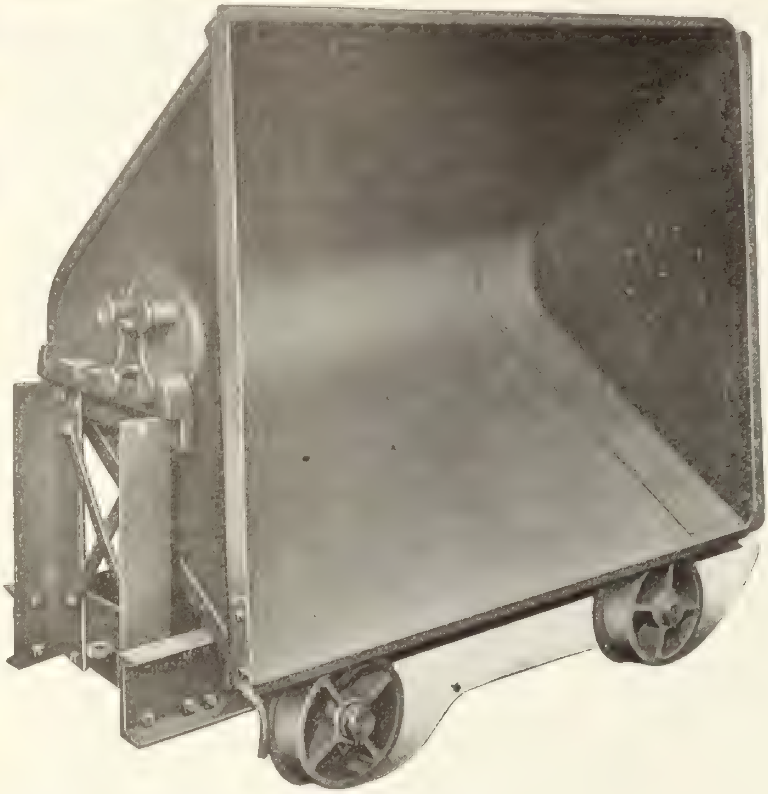
Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

SEND US BUILDING PLANS TO - DAY



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Simplest, Strongest, Best

We make them in any size
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We also make Winding Drums and
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SEAMLESS and LAPWELDED
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We carry in stock at Montreal, 5,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

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Estimates furnished promptly. Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
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Engines and Boilers

of all types and sizes, Heaters, Tanks, Pumps, etc.

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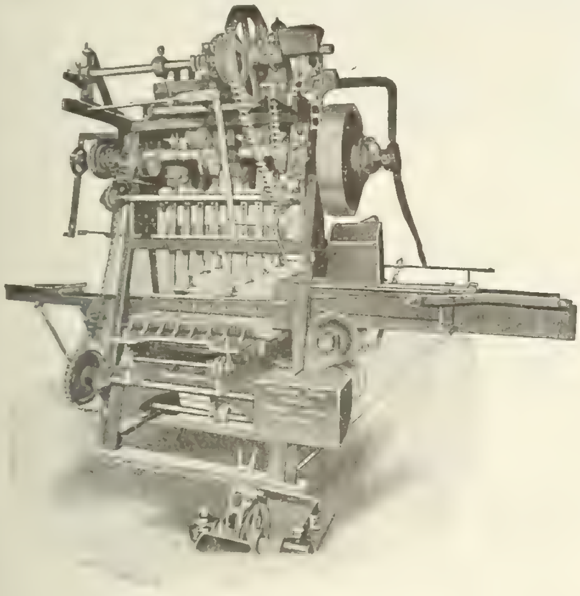
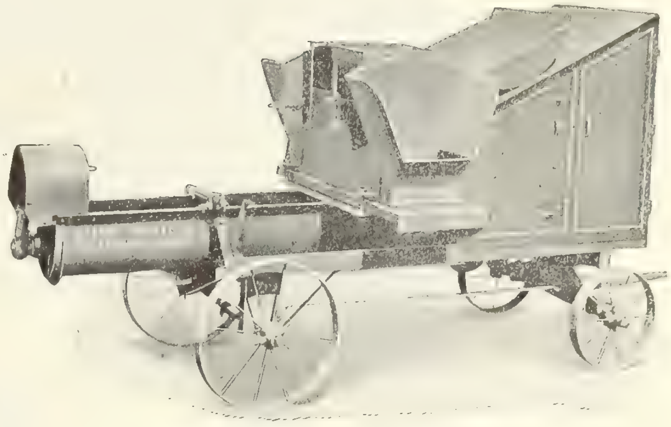
Cement Bricks

Here are the two Besser machines that make the best cement brick on the market. The Brick machine that will make 30,000 bricks per day—every brick the same.



Besser Power Cement Brick Machine



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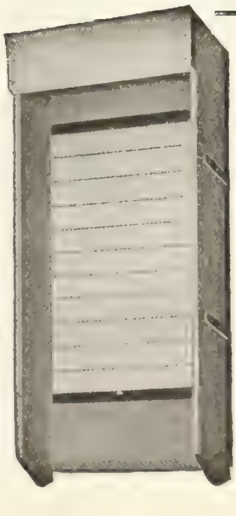

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SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
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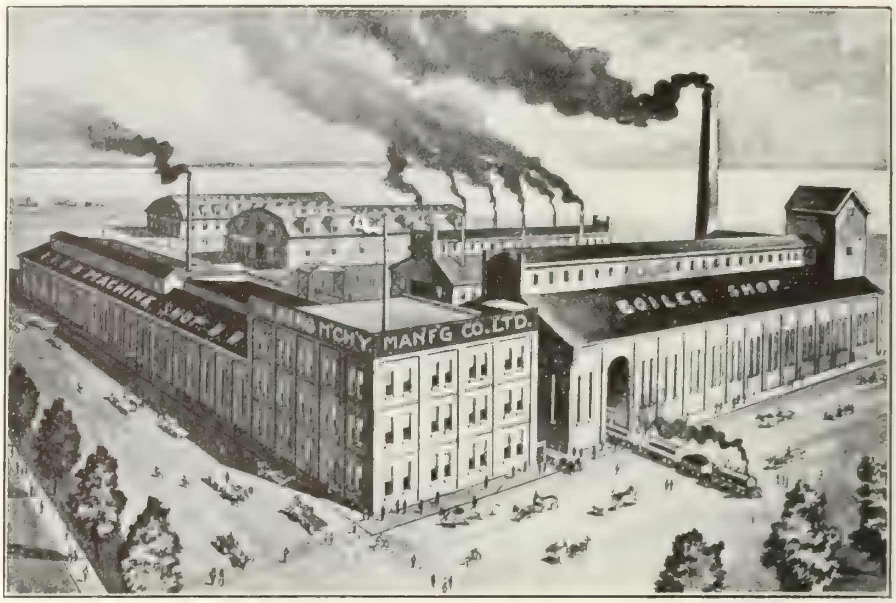

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Bathurst and Niagara Sts. TORONTO, ONTARIO

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Conveyor and Power Beltings

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Serve To Substantiate Their Superiority

Come with us on a mental journey through **our** Belting Plant, and see with your mind's eye the **unusual** precautions which we take to **win** and **hold** your confidence—to put **100%** of Service and Value in **each** and **every** Belt which we produce.

The Material Room

This is the material room where the various grades of duck are stored. Note its **fine** quality and the **immense** quantities which we have to purchase in order to cope with the demand for our Belting. Each **foot** of this duck has been **examined** by experts and the pieces which showed even the **slightest** imperfections, have been **discarded**. Even the **unseen** parts of our Belts are 100 per cent. Perfect.

Drying the Duck

The Duck is first sent to the drying room in order to prevent against any **possibility** of moisture remaining in it. When this precaution is **not** adopted the belts crack, stretch and break. **All** our duck is thoroughly dried before use.

The Frictioning Machines

Watch them putting the duck—from which all the "stretch" has been taken—through these huge frictioning machines. Note how these heavy steel drums drive and force the high-grade rubber stock, at **tremendous** pressure, through every strand and fibre of the duck. See how **carefully** the frictioned duck is **examined** for imperfections—flaws **can't** possibly pass unnoticed.

Cutting the Frictioned Duck

Here is the frictioned duck going through the cutting machines. Watch **how** perfectly the guillotine-like knives do the work and how each strip is **closely** scrutinized for ragged finish. There is **no** chance for human carelessness to mar the perfect work.

Vulcanizing and Finishing the Belt

Having **stretched** the frictioned duck to the **limit** of tension—thus eliminating any sagging tendencies from the finished belt—it is then sent to this huge belt making machine. See how the tough rubber stock is evenly distributed over the surface of the frictioned and vulcanized fabric.

Those experts are examining it again for imperfections before it goes to the vulcanizing room, where it is vulcanized into a permanently solid piece. After that the belt is finished and is as nearly perfect as human ingenuity can possibly make it.

Let Us Make Your Next Belt. It is Sure to Give You Satisfaction

If you are not getting the service you should from the belting you buy, let us demonstrate what our Beltings will do. We would welcome an opportunity to prove that they possess greater TENSILE STRENGTH, FLEXIBILITY, GRIPPING POWER AND SURFACE TOUGHNESS, than the Beltings you are now using.

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Montreal

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Large stock I Beams, Channels, Angles, Tees, Zees, and Plates always on hand.

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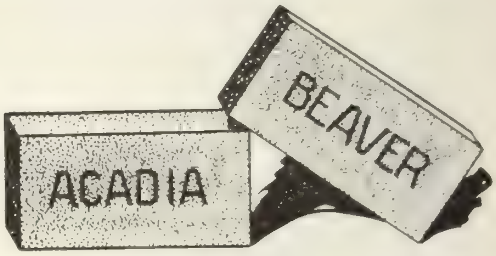

Shipments from Two Plants

Beaver pressed bricks are made at Pugwash works and Acadia brand at Elmsdale works. Rail and water shipments can be made from Pugwash and rail shipments from Elmsdale.

These bricks are uniform in size, quality and appearance.

Prompt Shipments Always

Nova Scotia Clay Works, Ltd.
HALIFAX - - NOVA SCOTIA

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BRAND
WINDOW
GLASS

GLASS
BENDERS
TO
THE
TRADE

THE TORONTO PLATE GLASS IMPORTING COMPANY, LIMITED

DON ROADWAY

Plate, Window, Figured, Stained, Wired, Bent, Mirror and Ornamental Glass

TORONTO

SIX REASONS

which account for the superiority of

Creosoted Wood Block Pavements

Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

Its Ease of Repair; No difficulty being experienced in removing and replacing the blocks; no expensive plant or skilled workmen required.

Its Sanitary Qualities; Creosote being a highly antiseptic and waterproofing material instantly destroys all germs, prevents the absorption of street filth and consequent decay.

Its Noiselessness; The rattle and bang of vehicles passing over its smooth surface absorbed and muffled till the quiet of the dirt road is obtained.

Its Dustlessness; Does not pulverize; the heaviest traffic only pounding down the wood fibres to offer the greater resistance.

Its Cleanliness; Having a smooth surface and being waterproof it does not differ in this respect from asphalt.

We manufacture blocks of the highest possible standard, the very best materials only being used and in the Dominion Wood Blocks we believe we produce an article that has no equal.

The Dominion Creosoting
Company, Limited
Vancouver, B. C.

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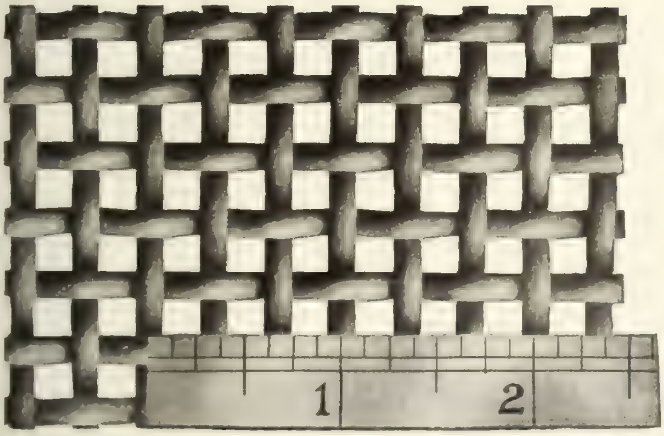

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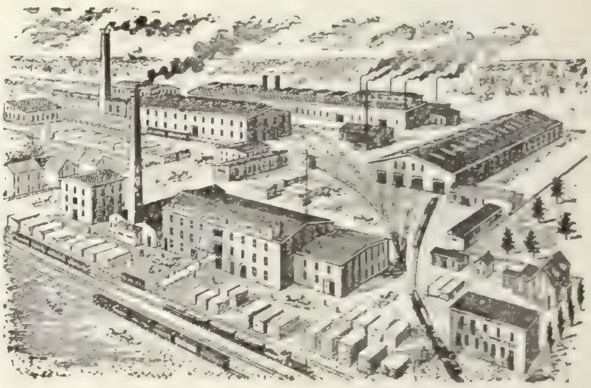

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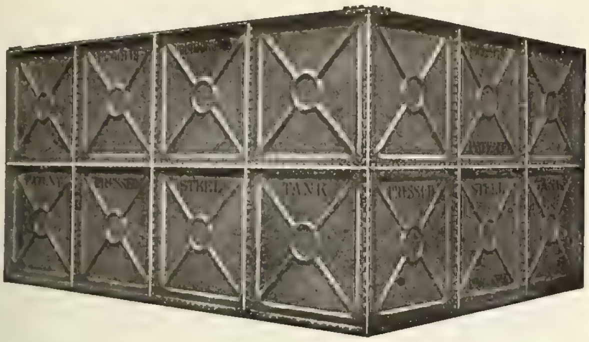

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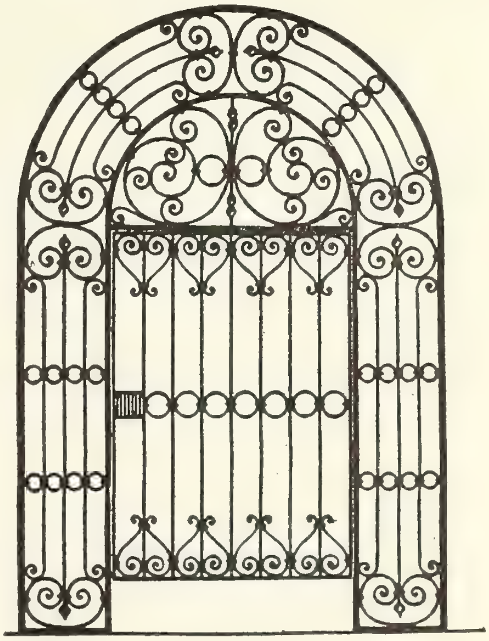

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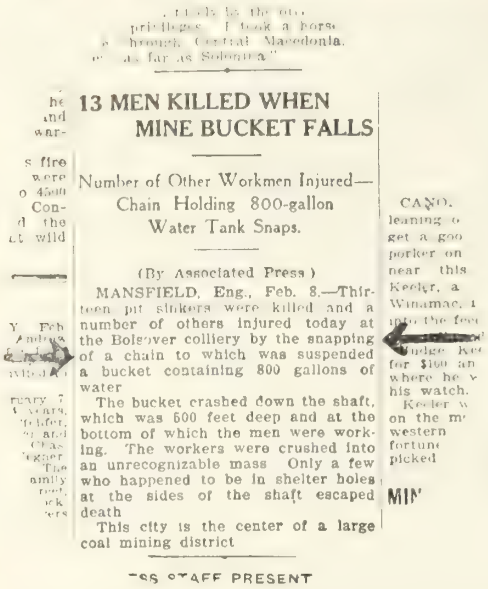

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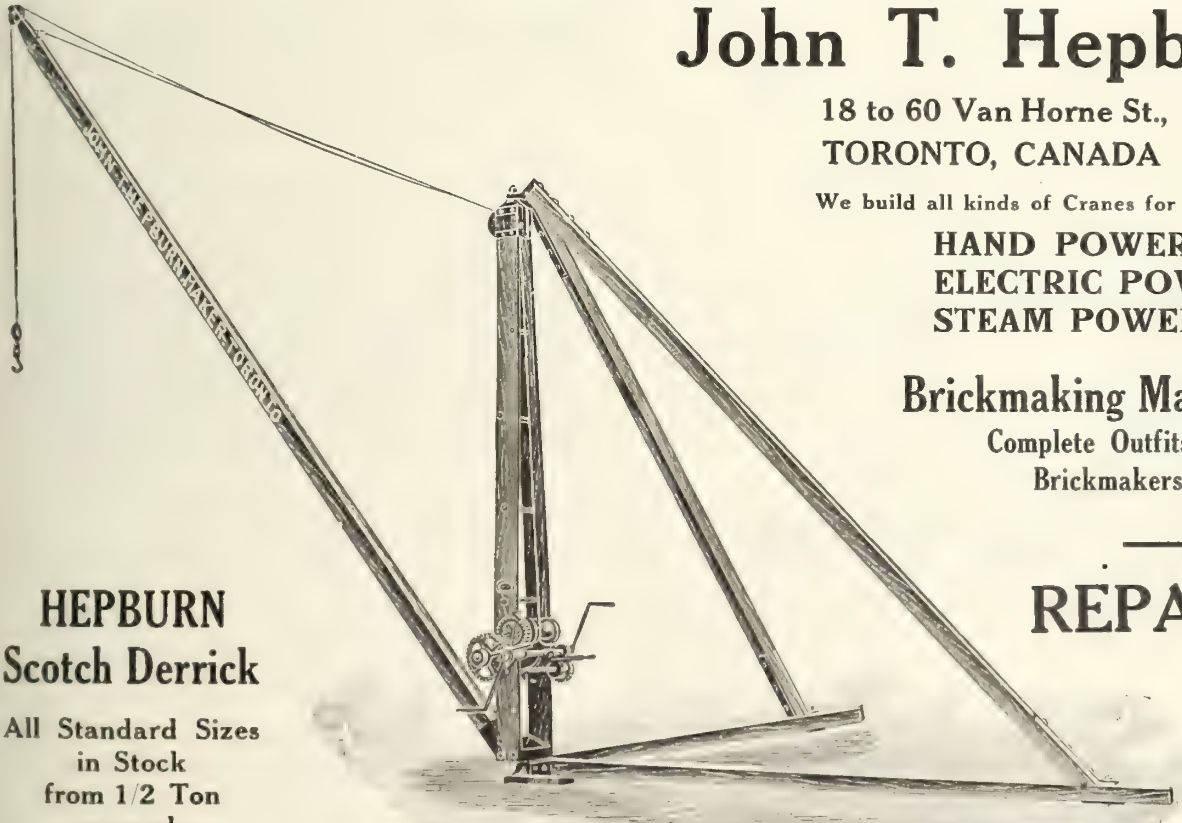
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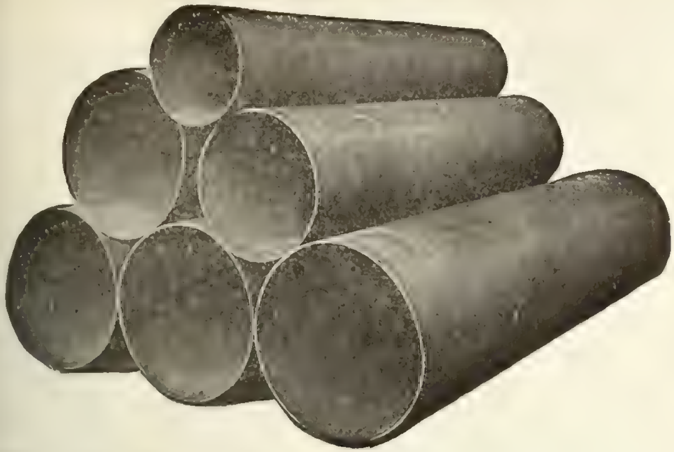

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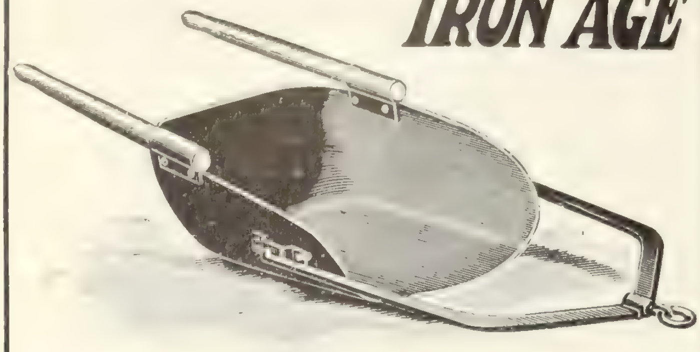

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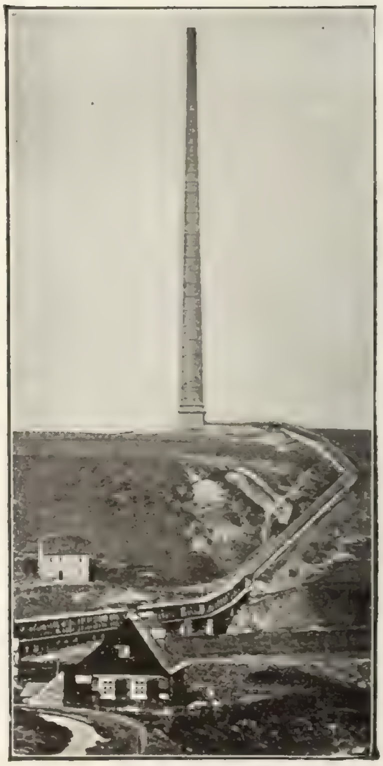

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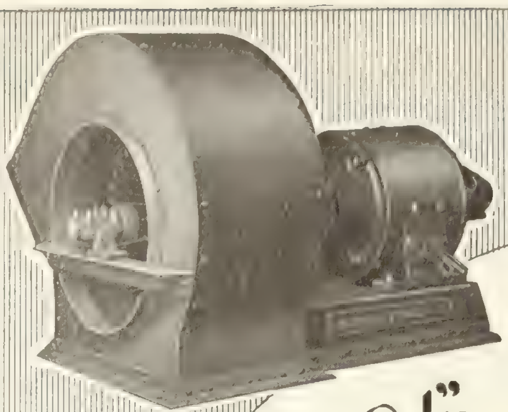

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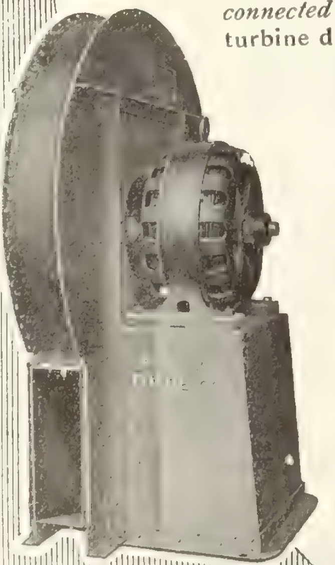

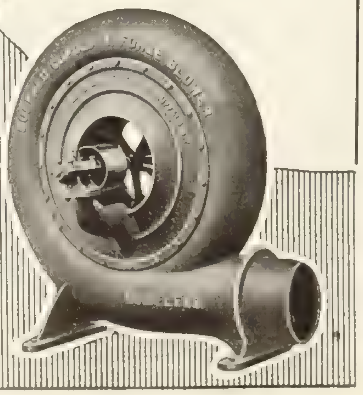

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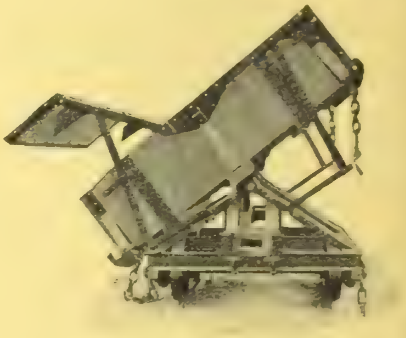

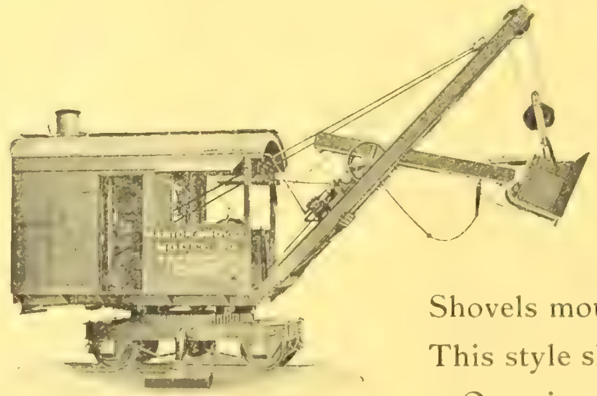

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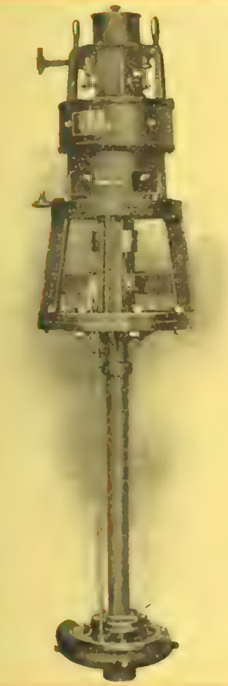
BRANCH OFFICES General Supply Company of Canada, Ltd., Winnipeg Agents
Ritchie Contracting & Supply Company, Ltd., Vancouver Agents

Vol. 27 Toronto, November 26, 1913 No. 48

ESTABLISHED 1886

Contract Record and Engineering Review



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For Your
Special Needs

The above is obtained by
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"MADE IN CANADA"

**Bent
Glass**

Made in all
Kinds of
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on Short
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Large Bent Plate Glass for Shop
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**The Toronto Plate Glass Importing
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(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
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THE
"JACKHAMER"

A Small, All-Steel,
Easily Handled Tool
for use in

DIGGING DITCHES
DRIVING TUNNELS and
BREAKING UP STONE

This tool is light in weight and handles steels up to 12 feet in length.

It has an Automatic Rotation and can be operated by Steam or Air.

*Have us send you
Catalogue K-68*

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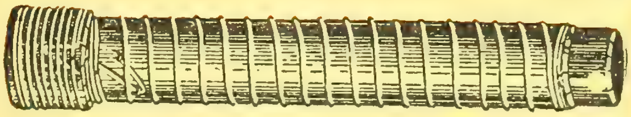


Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems,
Fire Protection, Power Plants,
Hydraulic Mining, Irrigation, etc.
One-half the cost of Iron Pipe—
and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6

Rock Crushing Plants

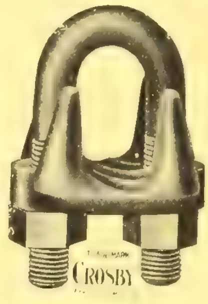
Complete, Self-Contained, Portable, Crushing, Grading and Loading Plant

The adaptability of the above plant, the ease with which it can "follow the job" makes it an ideal outfit for the Contractor. It is only one of our many combination machines for crusher work.

Full details of the various parts will be gladly furnished by any of our offices.

THE JENCKES MACHINE COMPANY, LIMITED

Sherbrooke St. Catharines Montreal Cobalt South Porcupine Vancouver Nelson



IF YOU ARE A CONTRACTOR

Using Wire Rope

YOU NEED THE

GENUINE "CROSBY" CLIP

IT HOLDS

Drop forged steel—Galvanized, cannot break, slip nor rust. Has nine times the strength of cast clips.

Made By

American Hoist & Derrick Co.

St. Paul, Minn.

SOLD BY

Dominion Wire Rope Co., Limited.—Montreal, Can.
General Supply Co. of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Stuart Machinery Co.—Winnipeg, Man. Vancouver Machinery Depot, Ltd.—Vancouver, B. C.
Gorman, Clancey & Grindley—Edmonton and Calgary, Alta., and Nelson, B. C.

CANADA Portland CEMENT

SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
PORTLAND
CANADA
CEMENT
MONTREAL

TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

Canada Cement Company, Limited

Head Office - Montreal

Sales offices at

Montreal - Toronto - Calgary - Winnipeg

200 Blows a Minute.

It's the rapid succession of short, sharp blows of the

UNION PILE HAMMERS

that do the work.

They do not damage the tops of steel sheets or of wooden piles.

Made in ten sizes--weighing 385 lbs. to 12 tons.

For all kinds of driving from the heaviest concrete pile and steel sheeting to the lightest wood and steel sheeting.

EFFICIENT
SIMPLE
ECONOMICAL

Catalogue mailed on request.

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MONTREAL, 318 St. James Street
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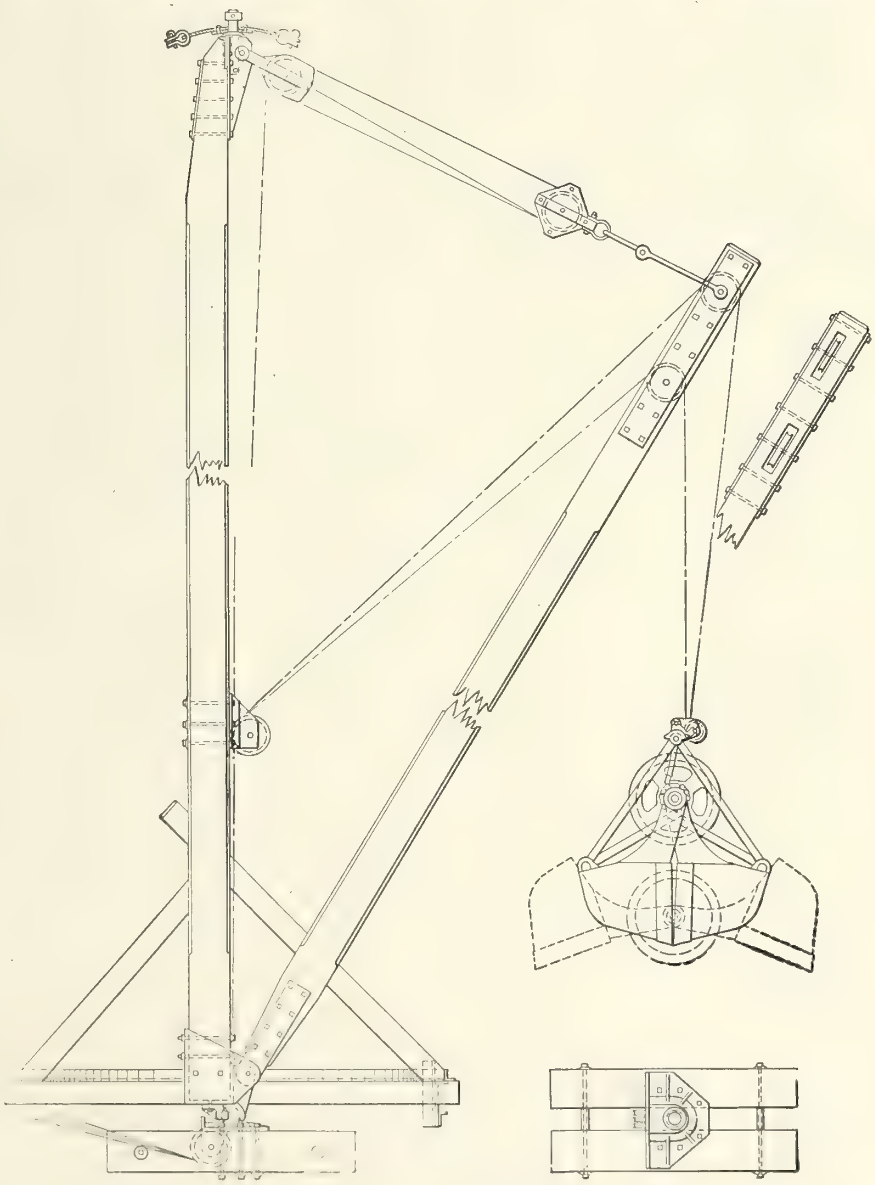
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

DERRICKS
and
DERRICK FITTINGS



Stiff Leg or Guy Derricks for regular or bucket work.

Special Hoisting Outfits designed to meet your requirements.

Derrick Irons carried in stock.

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  - Canadian Fairbanks-Morse Co.
  - Can. Ingersoll-Rand Co., Ltd.
- Architects
  - Weeks, Arthur L.
- Architects' Instruments
  - Stanley Co., W. F.
  - W. & L. E. Gurley.
- Architectural Iron Work
  - Canadian Allis-Chalmers, Ltd.
  - Canada Wire & Iron Goods Co.
  - Dennis Wire & Iron Works.
  - Eberhard & Wood
  - McGregor & McIntyre
  - Meadows Co., Geo. B.
  - Steel & Radiation Ltd.
- Architectural Metal Work
  - Feather & Roadhouse.
  - Ormsby Co., Limited, A. B.
  - Metallic Roofing Co.
- Architectural Terra Cotta
  - Black Building Supply Co., Ltd.
  - Don Valley Brick Works.
  - Gibbs & Canning.
  - Northwestern Terra-Cotta Co.
  - Toronto Plate Glass Imp't'g Co.
- Asphalt
  - Asphalt & Supply Co.
  - Barber Asphalt Paving Co.
- Belting
  - Can. Consolidated Rubber Co.
  - Goodyear Tire & Rubber Co.
  - Can. Fairbanks-Morse Co.
  - Dominion Belting Co.
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  - Canadian Buffalo Forge Co.
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  - Canadian Sirocco Co.
  - Sheldons Limited
  - Sturtevant Co. of Can. Ltd., B. F.
- Boilers
  - Berg Machinery Mfg. Co.
  - Canadian Allis-Chalmers, Ltd.
  - Boving Company of Canada.
  - Inglis Company, John.
  - Jenckes Machine Co.
  - Leonard & Sons, E.
  - Marsh & Henthorn.
  - McDougall Caledonian Iron Wks.
  - Mussens Limited.
  - Waterous Engine Works Co.
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  - Standard Underground Cable Co. of Canada Limited.
- Brewers' Machinery
  - Linde British Refrigeration Co.
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  - Weller Mfg. Co.
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  - Canada Wire & Cable Co.
  - Imperial Wire & Cable Co.
  - Standard Underground Cable Co. of Canada, Limited
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  - Abram Cement Tool Co.
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  - Browning Engineering Co.
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  - Hutchinson, M.
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  - Canadian Concrete Appliance Co.
  - Hopkins & Co., F. H.
  - Lecky & Collis.
  - London Concrete Machinery Co.
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  - Can. H. W. Johns-Manville Co.
  - Conduits Co., Limited
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  - Lecky & Collis
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  - Browning Engineering Co.
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  - Beatty & Sons, M.
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- Dump Cars, Wheels, etc.
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  - Boving Company of Canada
  - Canadian Buffalo Forge Co.
  - Canadian Sirocco Co.
  - Inglis Co., John
  - Jenckes Machine Co.
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  - Leonard & Sons, E.
  - McDougall Caledonian Iron Wks.
  - Mussens Limited
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  - Waterous Engine Works Co.
  - Wettlaufer Bros.
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  - Chipman & Power
  - Farmer, John T.
  - Galt Engineering Co., John
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- Hydrants
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  - Gartshore-Thomson Pipe Co.
  - Kerr Engine Company

(Continued on page 12)

The New
Royal Bank
Building,
Toronto,
To be
Fireproofed
Throughout
With
Don Valley
Porous
Terra Cotta
Fireproofing

The Largest Contract For Porous Terra Cotta Fireproofing

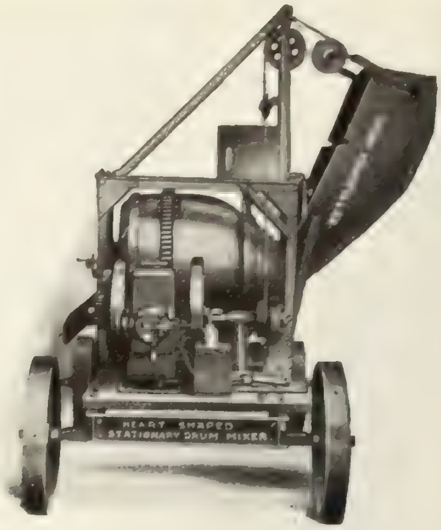
The largest contract ever placed for one building in the British Empire has been made for

Don Valley Porous Terra Cotta Fireproofing

to be used in fireproofing the Royal Bank Building, Toronto.

Don Valley Brick Works,
Limited,
Toronto, Ont.

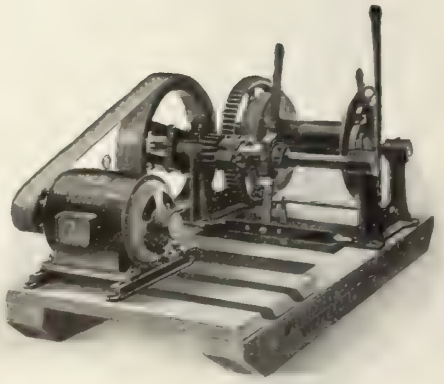
Wettlaufer
Hoists and Mixers



The house of Wettlaufer makes a mighty good hoist as well as the best mixer on the market. The hoists are simply and substantially constructed, and are invaluable equipment to every contractor.

The new Wettlaufer Mixer illustrated is equipped with a stationary heart-shape drum.

The material empties from the hopper direct to the drum where that notable heart-shape idea turns the material in every way possible to produce perfectly mixed concrete.


Single drum motor driven Wettlaufer Hoist

Attend a daily demonstration at any of our branches and see for yourself what good mixers we make.

Reversible single drum motor driven Wettlaufer Hoist on trucks

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

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Rogers' Portland Cement

AND CRUSHED STONE

Concrete Arch Bridge of Embro, Ont., built with Rogers' Cement

C. E. URE, Woodstock, ENGINEER BAIN & ROSS, Embro, CONTRACTORS

Cost price $4,200. Length of span 75 ft. Total length of bridge, including wings, 120 ft. Ten tons twisted bars used in reinforcment.

Rogers' cement is the most dependable for all types of construction and engineering-contracting work—especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, etc.

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

CRUSHED STONE

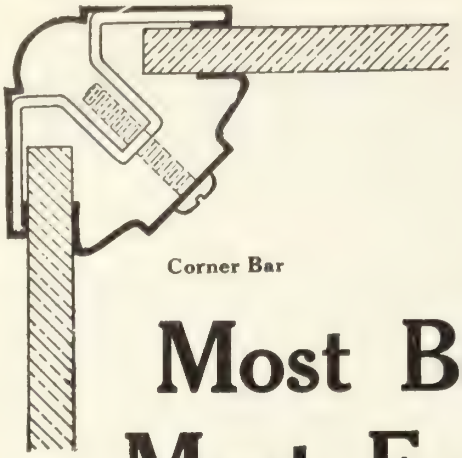
Our crushed stone is free from dust, dirt and mold—it is really clean stone—properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

Quarries at Dundas and Vinemount

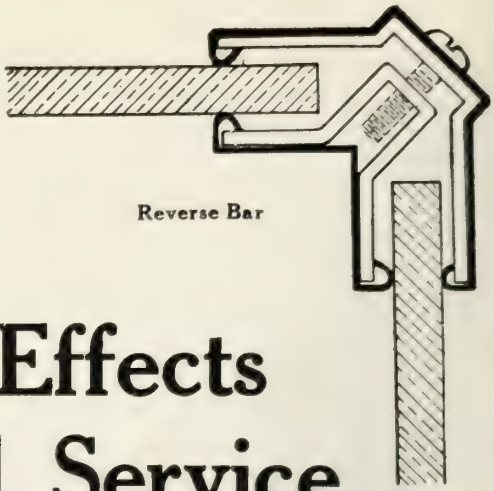
Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto



Corner Bar

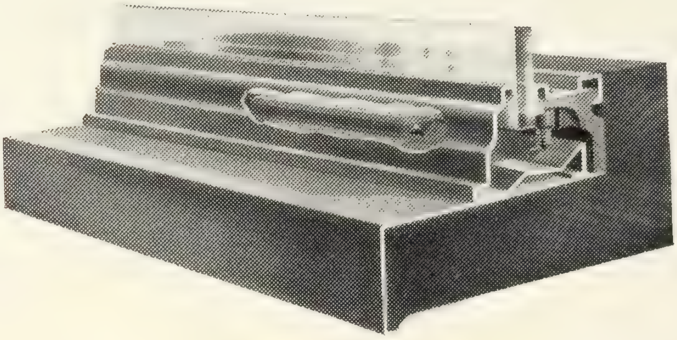


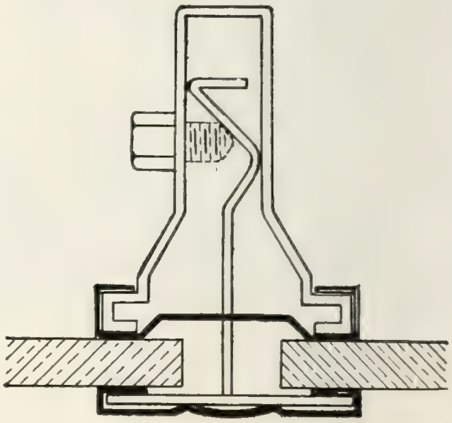
Reverse Bar

Most Beautiful Effects
Most Economical Service

Engineers, Architects, Contractors, Builders and Building-Owners and users, all find it to their advantage to have glass set by this most modern and improved system which makes

Business Producing Fronts





Zouri SAFETY & BURGLAR-PROOF SETTING FOR PLATE GLASS

OPERATING UNDER MURNANE AND MARR PATENTS

Zouri construction has many advantages. It is strongly reinforced with steel, with only a smooth, unbroken surface of solid copper exposed. No outside screws, indirect pressure, no breakage, low insurance. Perfect drainage and ventilation so window can be made frost and steam-proof if desired. Standard solid copper finishes.

BLUE PRINTS FREE. In order to show the simplicity and efficiency of the Zouri System we will send full size working blue prints of a store front to engineers, architects or contractors without charge. Write today.

You can always get Zouri construction promptly from any of our Canadian Agents who carry complete stocks.

Zouri Drawn Metals Company

Factory and General Offices— 227-241 West Schiller Street, CHICAGO, ILLINOIS

CANADIAN AGENTS
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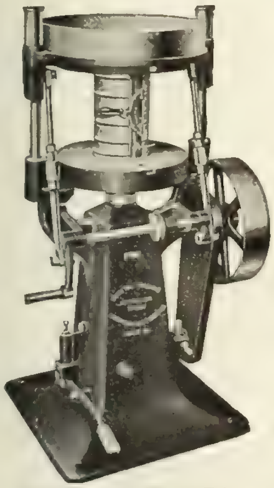
Saskatchewan Supply Co., Ltd., Saskatoon, Sask.

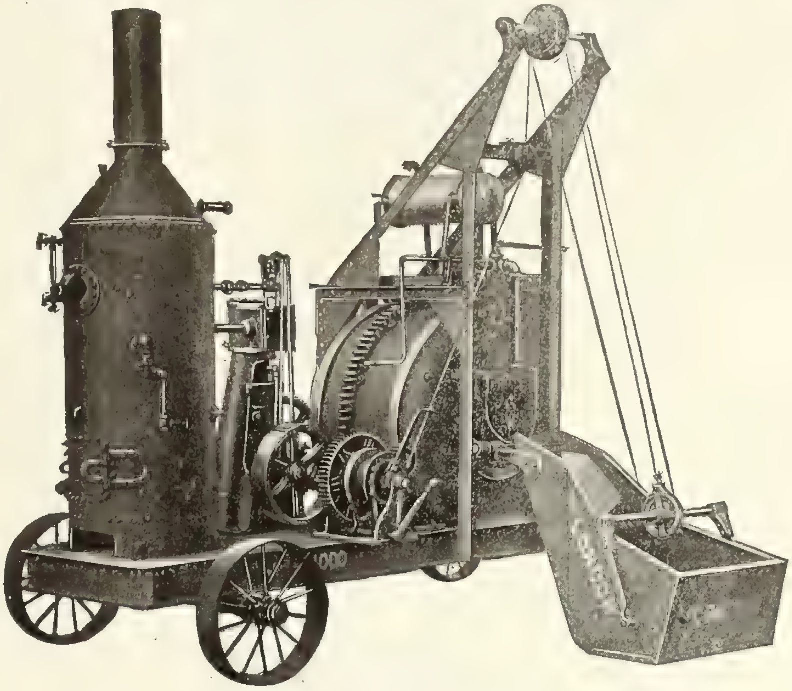
LONDON CONCRETE MACHINERY

Is Not Built Down to a Price, but Up to a Standard.



Dunn Cement Drain Tile Machine

We Cannot Afford to Make anything but the Best.

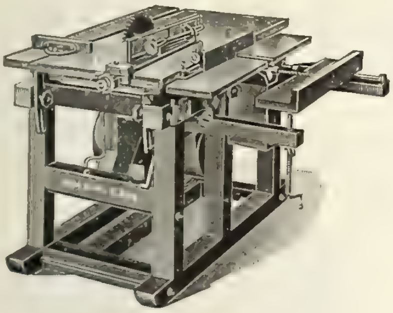


London Standard Drum Batch Mixer

There are Large Profits in the manufacture of Cement Drain Tile.

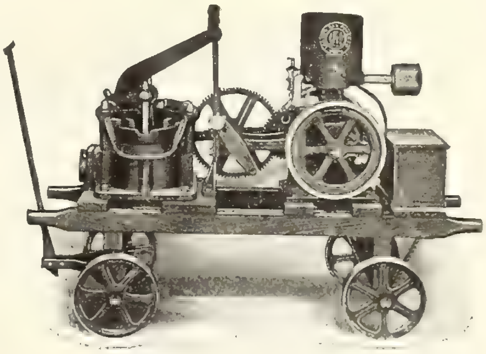
Write for Particulars.

Over 600 London Concrete Mixers sold in Canada in Three Years.



Variety Woodworker

No Contractor can afford to be without a Variety Woodworker



Diaphram Pump with Power

We manufacture a complete line of Contractors' Machinery: Concrete Mixers, Hoisting Engines, All kinds of Pumps, Block Machines, Brick Machines, Tile Moulds, Derricks, Cars, Ornamental Moulds, Wheel Barrows, Carts, Scrapers and Cement Working Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

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WINNIPEG (445 Main St.) W. H. Rosevear, Mgr.
CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (60 Richmond St.) F. D. Emsley, Mgr.

AGENCIES:
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MOOSE JAW, Sask. Bridge & Iron Co., Ltd.
REGINA, H. A. Knight
FORT WILLIAM, Northern Eng. & Supply Co.
MONTREAL, Foss & Hill Mach. Co.
QUEBEC, A. D. Masson

We are the Largest Manufacturers of Concrete Machinery in Canada.

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  Linde British Refrigeration Co.

Insulating Compounds
  Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
  Batts Limited
  Canada Office & School Fur. Co.
  Rhodes Curry & Co.

Kilns
  Canadian Buffalo Forge Co.
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4. To get the workman up from his hands and knees and eliminate the sore backs and bruised knees attending old style methods.

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In a word, the adoption of "ABRAM" tools on your next sidewalk construction contract will mean a saving of time, labor and money.

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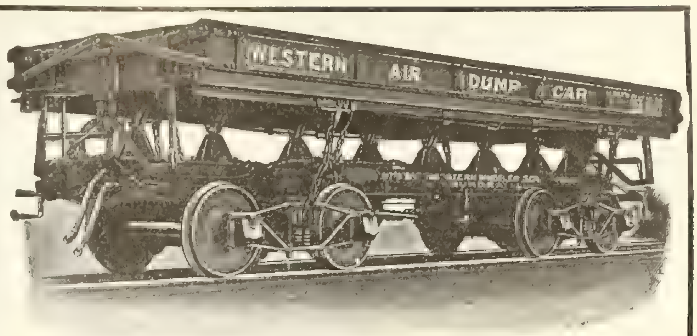

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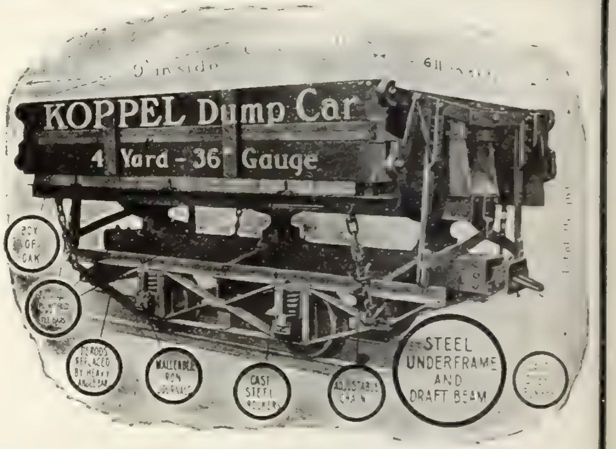

Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

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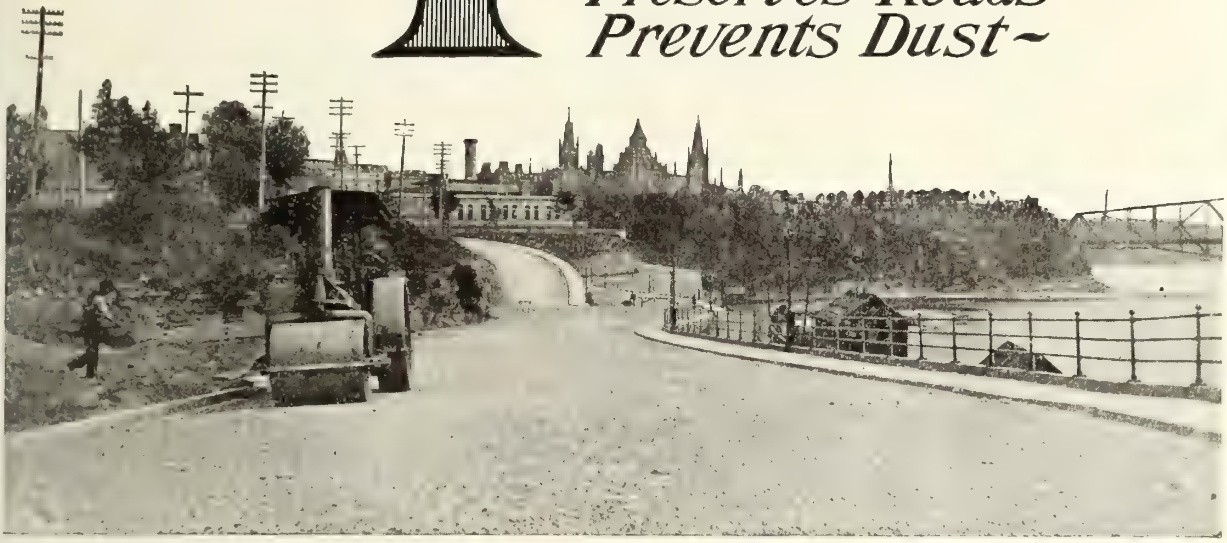

Lady Grey Road, Government Road, Ottawa, Ont. Canada's Mint in foreground. Parliament Buildings in background. Tarvia Modern Pavement finished Aug. 1, 1913.

A New Principle In Road Building

It has long been recognized by engineers that one of the greatest causes of the destruction of macadam roads by traffic has been the internal movement caused by the passage of heavy loads. The endless shifting and creeping of the lower courses of stone causes a grinding and pulverization which destroys the stone and breaks the bond.

To reduce this internal movement engineers have buried the larger stone under successive layers of finer stone. This fine stone forms dust more rapidly but the dust serves to protect the foundation of the road by acting as a cushion. Modern traffic makes the use of such dust cushions quite impracticable, for the automobiles not only stir up the dust but create entirely new conditions by scouring the surface of the road and breaking the bond with the backward thrust of their driving wheels.

The possibility of making roads automobile-proof by using Tarvia as a binder from top to bottom of the wearing-course during the construction of the road has now been satisfactorily demonstrated. The Tarvia fills the voids and forms a tough, durable matrix in which the stone cannot shift or grind. Consequently it has become possible to use large stone in a much greater proportion to the construction. The fine screenings and stone chips are used only on the surface as a finishing coat.

Traffic wearing away the surface strikes the layer of large stone in the tarvia matrix and makes little or no impression upon it. The large stone pulverizes but slowly and cannot be torn loose by automobile wheels. It does not change contour, sheds water instantly, is free from dust, costs but a trifle more to build than ordinary macadam, costs much less to maintain.

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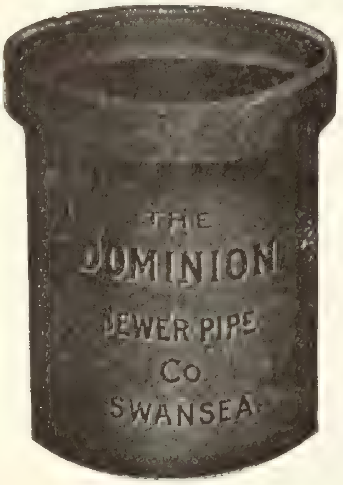

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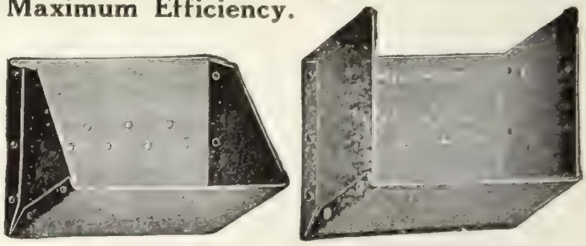

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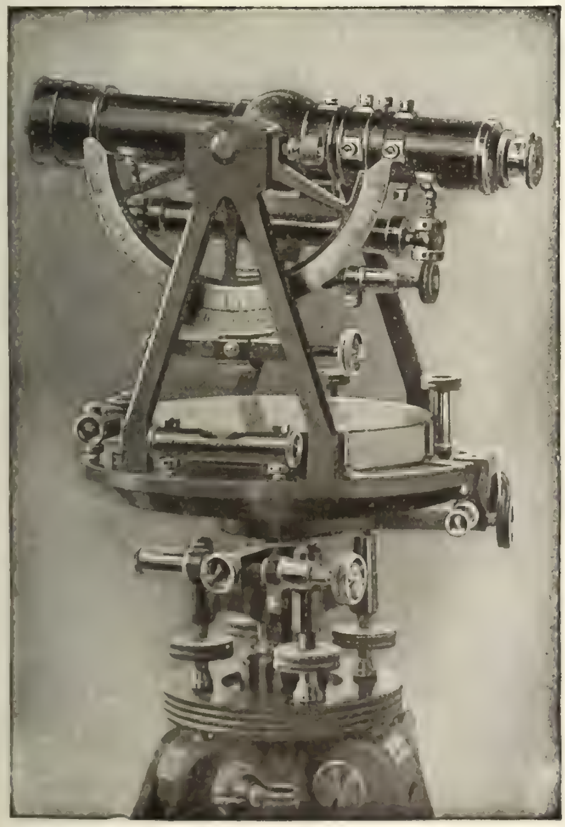

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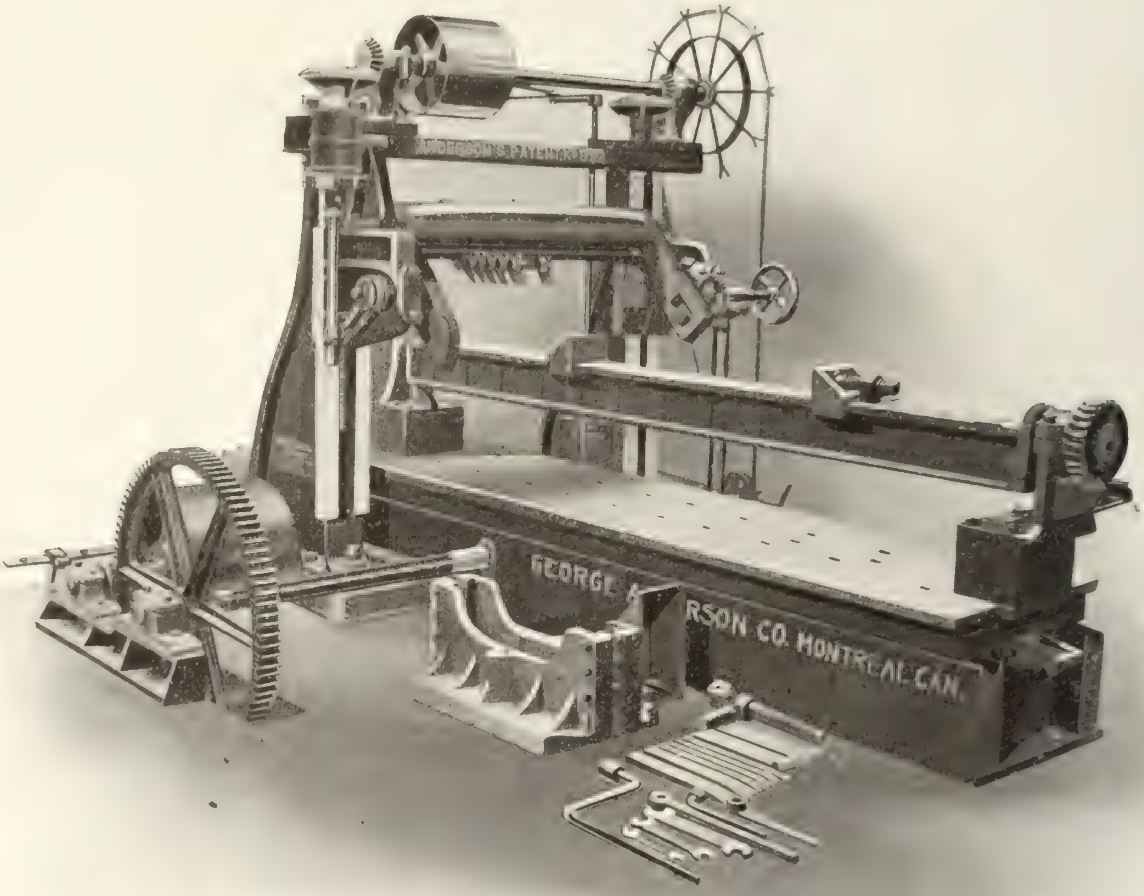
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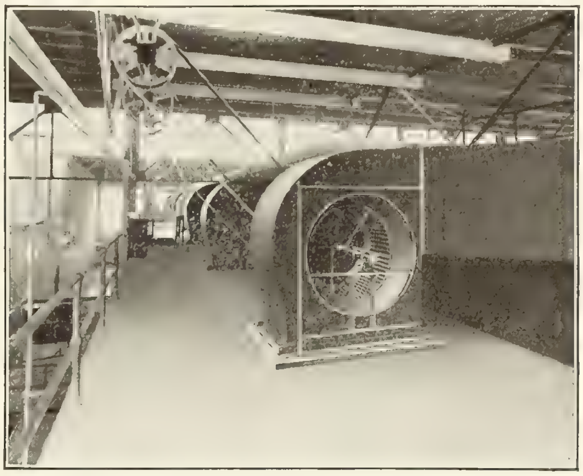

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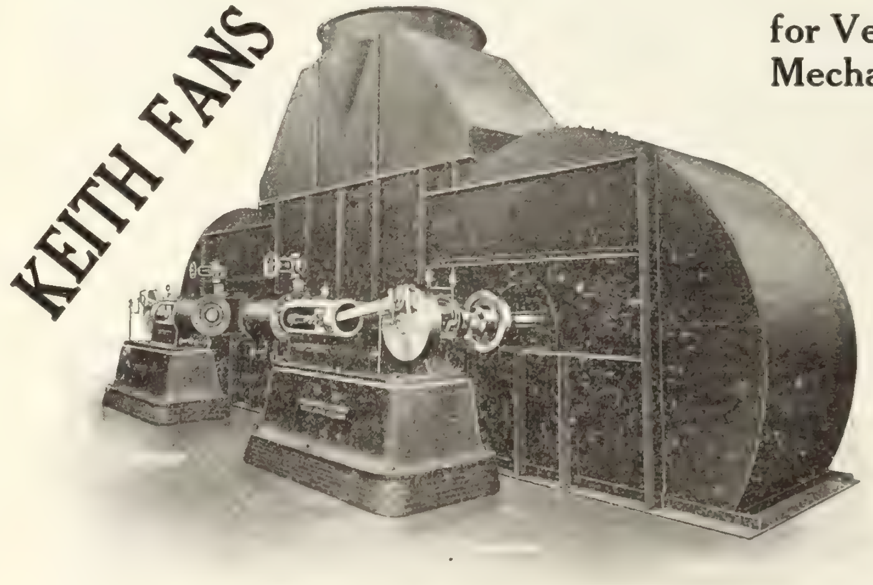

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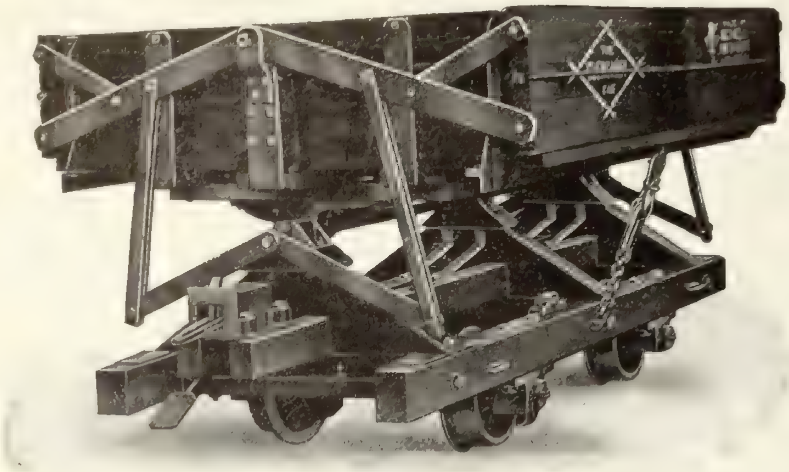

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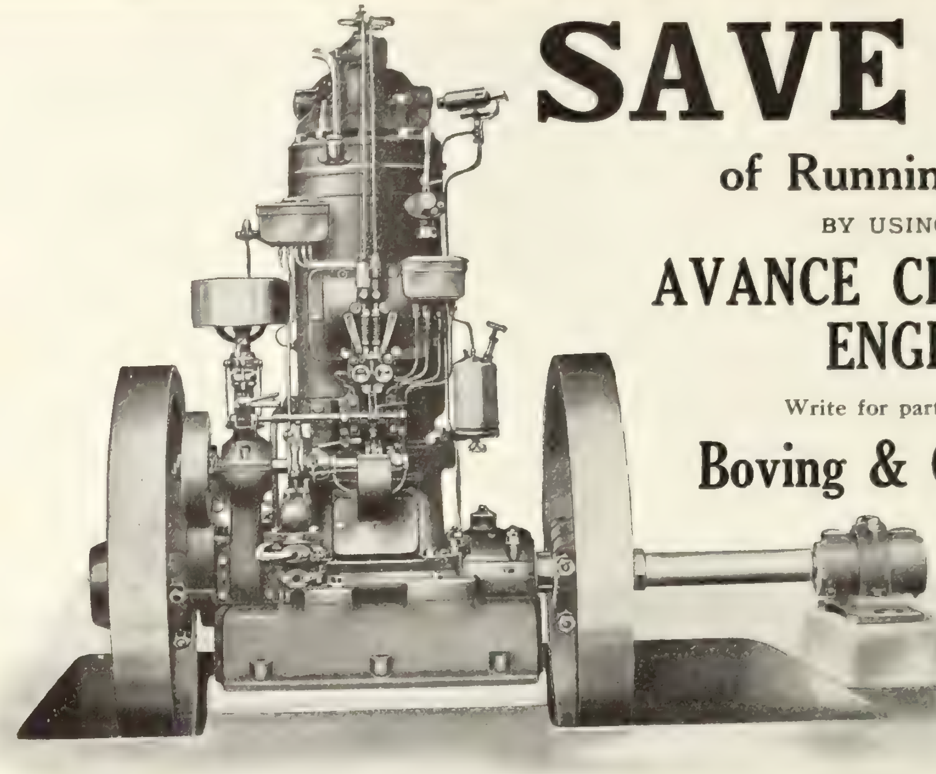

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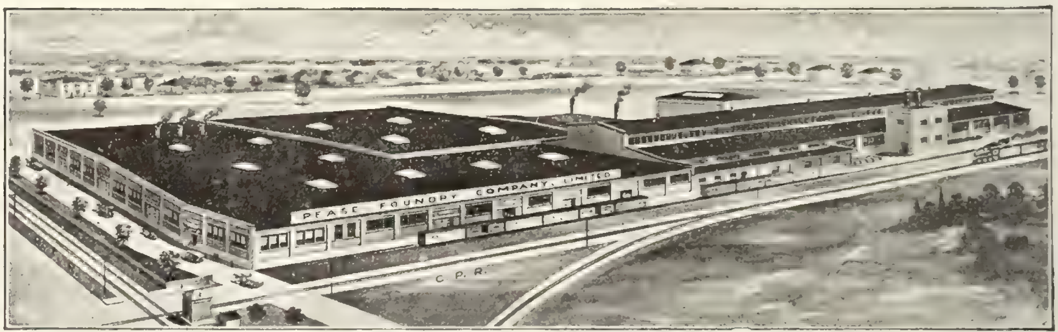

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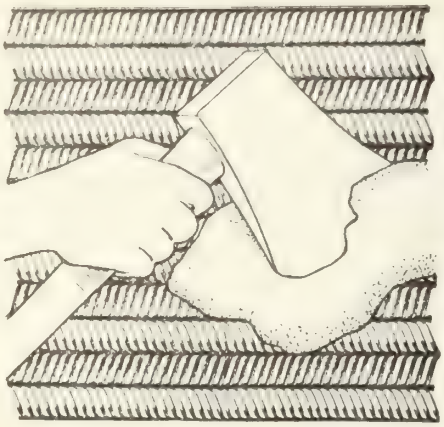
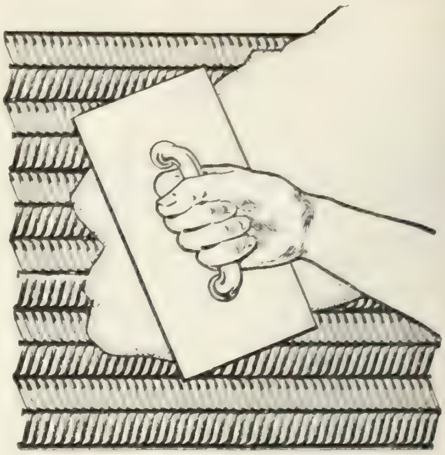
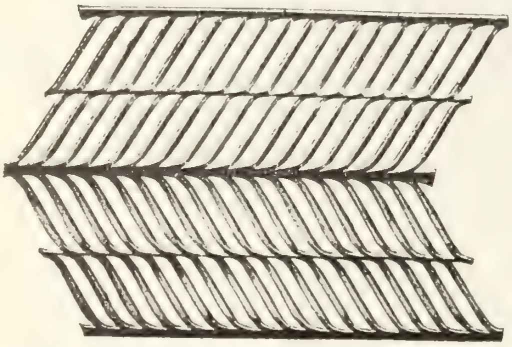


Who will cover the most lath, the man with the axe, or the man with the trowel?

The plasterer uses a trowel because it presents a flat surface on the mortar and spreads it.



HERRINGBONE LATH



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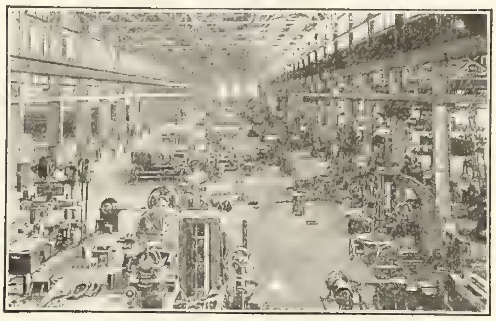

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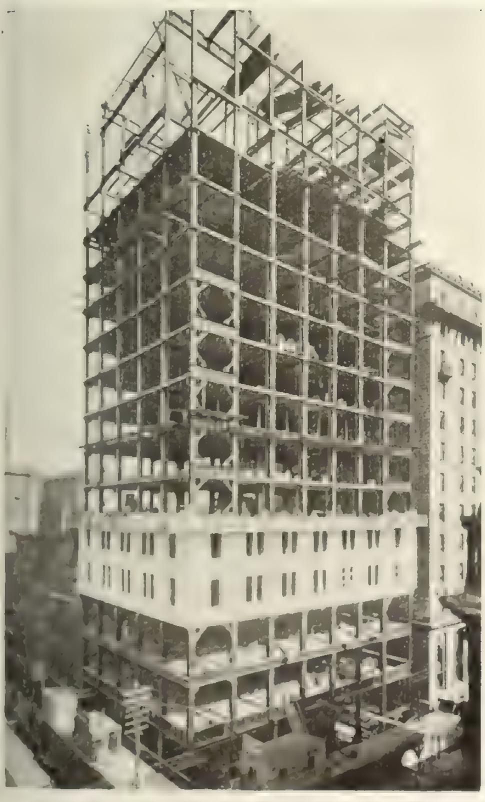

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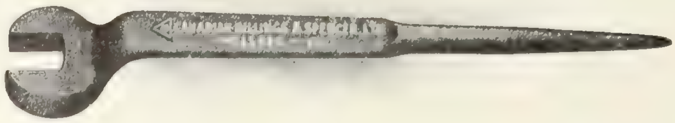

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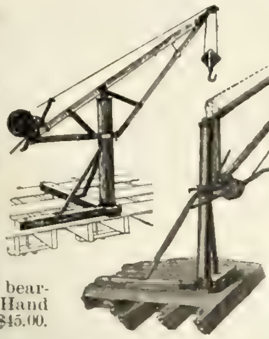

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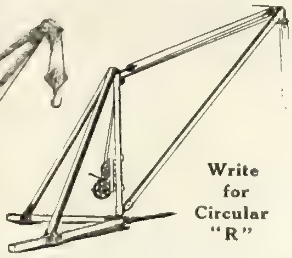

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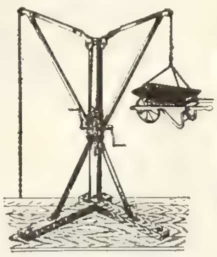

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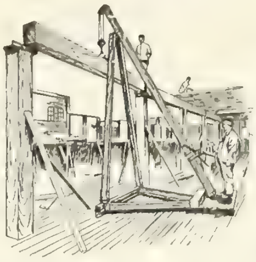

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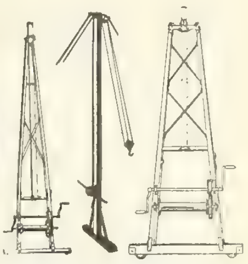

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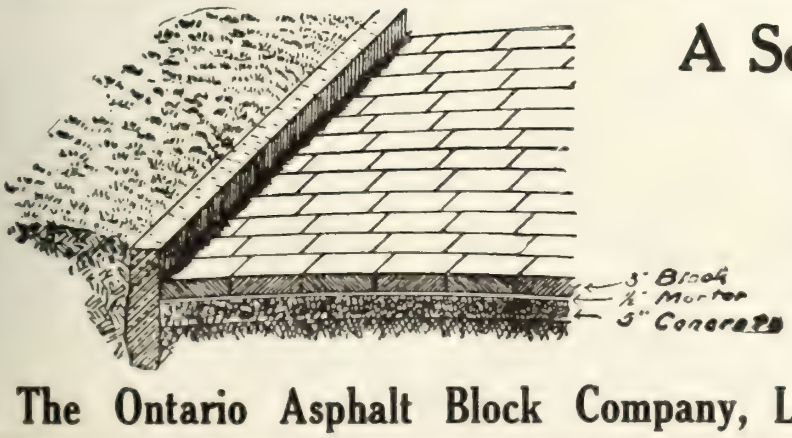

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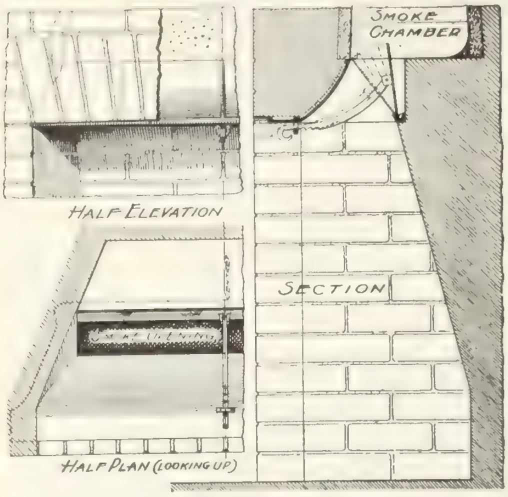

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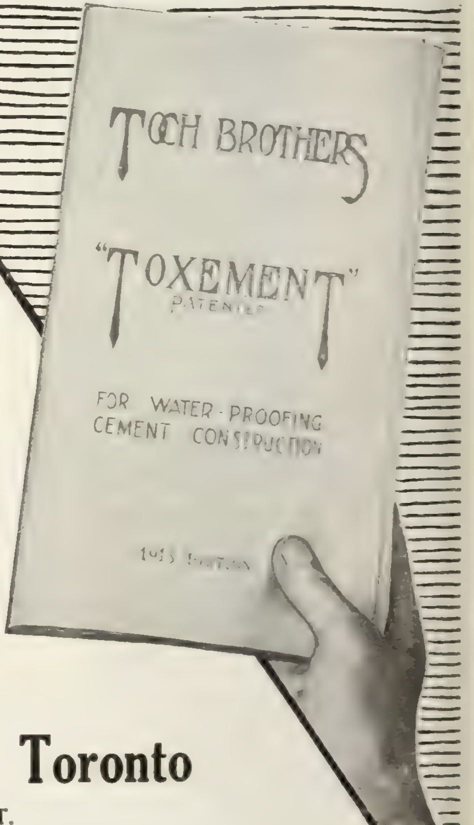

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Conditions in the Brick Trade

THE present condition of the brick market affords a favorable opportunity for investigating the causes of the increase in supply over demand. Enquiries are being made as to whether a market can be found for the surplus resulting from the largely increased output this season. Building permits in all parts of the country have increased considerably during recent years, but the demand for brick and other clay products has not increased in anything like the same ratio. For some time the supply has more than counterbalanced the demand. New brick plants have been opened up here and there, many of these having a capacity for an immense output; besides, there have been many additions to the smaller plants, so that it is easy to understand why the demand is not keeping pace with the supply.

The trend of the observations of prominent brick manufacturers in Toronto is not encouraging in regard to the present condition of the trade, although everybody is optimistic as to the prospects for the coming year. One well-known manufacturer says that up to the beginning of the present year we were importing at the rate of thirty million brick per annum. That state of affairs has changed completely during the present year owing to the increased number of plants. One cause of the falling-off he attributes to the stringency in the money market, which, in his opinion, has practically eliminated speculative building. He admits that there has been a large increase in the output, but asserts that it is quite evident that the building trade in Ontario at least must have increased proportionately to the increased production of brick, adding, however, that owing to the period of financial stringency it is difficult to gauge the true conditions of supply and demand as they obtain in Ontario.

For years the speculative builder has been an important factor in Toronto's building trade, and it is easy to see how his operations are retarded during a period of financial stringency when he is unable to obtain loans without great difficulty. The builder of small houses and those having ready money at their command are practically the only people who have been building to any considerable extent. The builder with sufficient financial resources finds some encouragement in the slightly-reduced price of brick brought about by the surplus supply.

The drop in the trade barometer this year placed the brick manufacturer in an unenviable position. Last year such was the demand that he was at his wits' end to turn out brick quickly enough. He builds extensions and installs additional equipment only to find that conditions have changed and that the market is over-supplied. We are told that the only redeeming feature of the brick trade this year has been the fireplace business.

It is a source of gratification that signs of improved conditions in the near future are not wanting. From many parts of the country we have received returns registering higher figures than 1912. A conspicuous example is the city of Toronto, whose permits for last month exceeded those of October, 1912, by nearly half a million dollars and whose record for the year to date is well ahead of that of last year. It is surely a fair interpretation of these signs that conditions in the brick business will brighten up in the near future.

Everybody is looking forward with confidence to 1914 and we believe that this optimistic outlook is justified. There are many who declare with absolute conviction that all constructional records will fade into insignificance when compared with those that are to be made next season. Be this as it may, things are on the mend, and the year with the unlucky number is nearly closed.

How the Financial Stringency is Being Overcome

THE decrease of $972,911 in the customs revenue for October, 1913, as compared with that for the same month in 1912 can be said to illustrate one way in which the financial stringency is being overcome. Although strictly speaking the houses in the import business are supposed to have enough capital to pay the duties on imports with their own funds, says the Financial Times, the fact is that many of them find it necessary to go to their bankers with requests for direct loans in order to effect the release of incoming merchandise from the hands of the custom officials. In this way the banks are subjected to heavy demands from their importing customers whenever the custom collections are at record figures; even then the loans thus granted are merely temporary. It is a relief, however, to find that the strain on the banks is visibly diminishing owing to the reduced applications for credit for several months back. In the past two or three years it has been no secret that the commercial credits issued by the banks to facilitate the importation of merchandise have caused the financial institutions to draw heavily on their balances in London and New York, and that in spite of the large sums received as proceeds of Canadian issues in London, the outside safety fund has had a marked tendency to decline. Thus the banks have been relieved to a certain extent through the diminishing demands for funds for customs and freight charges and for commercial credits. Although the industrial loans stand at a comparatively high level, this tendency is towards a decrease since the manufacturers are now in many instances laying off hands and purchasing their raw materials more sparingly. Also, they have largely ceased to press their bankers for building loans and for loans for the acquisition of more extensive equipment.

Canada as a Constructional Field

BRITISH recognition is given slowly and conservatively and for this reason its momentum is a force that cannot be overlooked in our calculations. Leading British engineers are being led to recognize the Pacific Coast of North America, and especially Canada, as the best new field for their enterprise.

The engineering supplement of a recent issue of The Times publishes a two-column analysis of the preparations of the Pacific ports and harbors for the opening of the Panama Canal, and gives Vancouver first place. It says that the natural conditions of Vancouver, Prince Rupert and Puget Sound may well excite envy along less-favored coasts, and it endeavors to excite the interest of British engineers by the calculation that the sum of $350,000,000 is already being expended on railways by private companies in lines to the coast, harbors and terminal facilities, the greater part of which will go to improve the ports of British Columbia. Another $150,000,000 is being spent by municipalities, port and harbor boards in the United States, assisted in some instances by the U. S. Government. To this must be added the expenditures of the Dominion and Provincial Governments.

A full appreciation of the great potentialities of our country is what we have been asking from Great Britain for two generations. Slowly but surely it is coming.

Keeping the Cost Within the Estimate

HOW to build a $34,000 house for $25,000 is substantially the problem which the average owner vaguely expects architects to solve. Possible variations seldom reduce the inherent difficulties of the task proposed. According to The American Architect, when a California architect recently failed to perform this financial strategem, he was deprived of his fee by the court, on the ground that "he should have kept the price within the original estimate, if he desired to collect for his services under his contract."

We are not informed as to the exact provisions of the architect's contract with his client, but from published statements it would seem that the client's action in acceding to an expenditure of $9,000 more than was originally contemplated was in itself sufficient to release the architect from responsibility in the matter of cost. However, with our confidence in the infallibility of judicial decisions on matters architectural, we are forced to believe that the architect was at least lax in the protection of his own interests, when he entered into a contract that could be interpreted with such unfortunate results to himself, or failed to have it properly supplemented when it became evident that the owner's demands could not be supplied at the stipulated price.

Everyone concerned in building knows the tendency of wishes to outstrip wealth, but if the client really desires to keep the cost within a stated amount, there is, of course, a way by which the architect with the owner's co-operation can accomplish such a result. It consists in making the specifications both definite and comprehensive, and in so restricting the plans, that the full contract price plus the architect's fee, will be within the appropriation, and leave a small balance as a factor of safety.

If the cost must in some manner be made a condition of his employment, he should conserve the right to modify the specification in consultation with his client, so that the investment may not eventually exceed the contemplated sum. The responsibility for any subsequent deviation from the specifications tending to increase the cost, should then be borne in writing by the client. Such procedure will tend not only to prevent financial disappointment of both architect and client, but also to minimize popular criticism of the supposed extra costs sustained through the employment of an architect.

The method of making the architect's fee contingent in a sense upon the cost of a building, in that a certain amount may not be exceeded without nullifying the agreement upon which he is employed, may or may not have points in its favor, but if the mere mention of a sum as the desired limit of expenditure before plans are drawn, has the legal effect of depriving an architect of remuneration in the event of a larger sum being required to meet the owner's demands, it is important that architects take cognizance of the fact. Moreover the architect should bear in mind that he is not a contractor in any sense of the word and should not enter into any agreement which might prevent his giving disinterested advice to his client.

Estimates and Time Schedules in Large Building Construction

IN a recent paper presented before the Cleveland Engineering Society, James I. Stuart, Contracting Engineer, Pittsburgh, discussed business methods in construction work. One of the essentials in successful construction brought out in Mr. Stuart's paper is that the engineer in charge of the work should anticipate each step in the progress of the building, and outline a complete system for its erection, including the various steps from the time the drawings are received from the engineer or architect until the completed building is turned over to the owner. The first step in such a process is to make a complete estimate of the cost of the structure from the drawings and specifications, including every item mentioned in the specifications or shown on the drawings. In addition to this there are other small items which are not mentioned in the specifications, but which are necessarily a part of the cost of the building and should be included as such. Under the latter are such items as the cost of administration, liability insurance, temporary buildings, expediting, tools and machinery and numerous smaller items.

After the estimate of the total cost of the building has been made—and an estimate should be made of every building, whether the work is to be let on a lump sum contract, cost plus a fixed sum, or on a time and material basis—the next step is to make up a time schedule allowing fixed periods of time for the completion of each part of the building. This must be done most carefully, as on this schedule are based the dates of completion of the different contracts for material and the contracts with sub-contractors for furnishing such portions of the work as are not to be executed by the general contractor's force in the field. This time schedule is made after a thorough study of the drawings, the site of the new project and a familiarity with the estimate which give the quantities of the different kinds of material and assist in estimating the length of time required to complete the various stages of the work.

The Gypsum Industry in Canada

SEVERAL companies are being formed, including two in Montreal, to exploit large deposits of gypsum in the Maritime Provinces. In view of this fact, a few particulars of the mineral itself will be of interest to our readers. In a special pamphlet on "Economic Minerals and Mining Industries" published recently by the Department of Mines at Ottawa, we are told that the quality of gypsum found in Canada, especially the white rock of Nova Scotia, New Brunswick and Ontario is of exceptionally high grade. The output in Canada of crude gypsum for 1912 was 576,498 short tons, valued at $1,320,823, as compared with 518,383 tons with a value of $993,394 in 1911. Gypsum is used in many of the fire arts, being extensively employed in the manufacture of structural materials, such as plaster of paris, hardware plasters, cement, etc. It is also used in the crude state as a fertilizer. The market for gypsum is almost unlimited. The cost of production, according to Government figures, averages slightly below 45c a ton and the average price obtained at the quarry in 1912 was $1.08 a ton. In 1908 and 1909 the average price was $1.69 and $1.71 respectively. The exports of crude gypsum from Canada, it is interesting to record, have increased from $201,912 in 1900 to $416,725 in 1910 and $422,506 in 1912. Imports of plaster of paris have increased from $6,492 in 1900 to $123,965 in 1910 and $205,676 in 1912. From these facts it is evident that the industry has a good future in Canada. Amongst the new organizations are:—The Cheticamp Gypsum and Plaster Company, Limited, The Nova Scotia Plaster Company, Limited, and The Iona Gypsum Company, Limited. A Montreal syndicate is being formed to operate a large deposit at Ingonish, Cape Breton.

A Balkan Competition

WE trembled a short time ago for those enterprising architects who had ventured to compete for the new Royal Palace at Sofia, says our London contemporary, The Builder. Anything then seemed possible—even a Bulgarian Republic, if, indeed, the rival States of Roumania, Servia, and Greece did not claim the whole soil of Bulgaria for themselves. But the Peace of Bukharest left us Bulgaria, and the Bulgarians have not turned out their rulers! But we learn from an official postcard that, though "Les evenements politiques dans les Etats Balcaniques entravent encore le transport des projets et la constitution du jury pour les concours internationaux du Palais Royal et le Palais de Justice a Sofia," the Ministry will receive designs on April 1 next. But surely the Bulgarian Government might have chosen a more reassuring date on which to receive the efforts of Europe in the shape of designs for its Royal Palace and much-needed Temple of Justice! When an architect has decided to compete for any building it is well for him to be undistracted by doubts, and we feel that the date of sending in may occasionally give the red-hot enthusiast a cold fit of wonder as to whether he is not designing a chateau en Espagne. Still, architects may hope that on April 1 next there will still remain a Bulgarian Government which will, at least, appreciate their efforts and reward the winner with Bulgarian gold and Balkan honours! How long will it be before a federation of the Balkan States, founded on brotherly love, necessitate a Union House of Representatives? We hope for those happy days when the Bulgarian wolf will lie side by side with the Roumanian fox, and the Servian eagle will sing them both to sleep in concert with the Grecian nightingale.

LETTERS

The Cost-Plus-Commission Basis

Editor Contract Record:

Your editorials on the subject of tendering, published in your issue of November 12, are the expression of principles to which I have clung for many years. As an illustration of the manner in which contractors are put to needless trouble and expense in figuring I do not think you can find a better example than the Methodist Publishing House in Toronto, upon which a great many responsible firms have probably wasted considerably money. As far as municipal work is concerned the end of competitive tendering is a long way removed, but in building construction evidence is not wanting that people are becoming educated more and more to the fairness of the cost-plus-commission basis for the execution of such work. Anything that you can accomplish in this direction will be appreciated by at least one of your readers.

Yours truly,
"A Building Contractor."

A British Columbia Branch of the Canadian Society of Civil Engineers

Editor Contract Record: Nanaimo, B.C.

Although I was not present at the last Annual Convention of the Canadian Society of Civil Engineers, I have eagerly followed the proceedings of that body in the Contract Record and I am strongly of the opinion that a provincial section of the Society should be formed in British Columbia.

When we consider a Society with its head offices thousands of miles away, the possibility of local members showing much enthusiasm is very remote. This is sadly detrimental both to the Society as a whole and to the members individually. If we could form a branch society here it would certainly give greater impetus to the cause of good engineering.

It would be a greater advantage to form a Municipal Branch of the Canadian Society of Civil Engineers. Personally, I am not in favor of forming new societies with confusing titles—and there is the danger of antagonizing the various interests. We are all engineers: we have different branches of work to perform, but our aims are centred in one ambition, viz., the raising of the standard of the engineering profession. We must keep this ideal high and show that the trained Canadian engineer is not only willing but capable of carrying out every engineering scheme without having to fall back on outside or foreign help.

Again, the Canadian Society of Engineers generally, and the British Columbia Branch in particular, feel the great impetus that will be given to our educational facilities by our new provincial university. I am confident that the British Columbia Branch will rally around this great educational institution. We must co-operate in that one great aim in helping to make our university a seat of learning and a home for those whose desire is to search for still more light. We do not want to produce merely book-learned men but rather men who are confident of success **because they know that they know their engineering.**

Yours truly,
S. B. Bennett.

Canadian Engineers Weak Numerically and Financially

Editor Contract Record: New Westminster, B.C.

The Canadian Society of Civil Engineers has not proved to be a huge success as at present constituted and I do not think that the time has yet arrived for the organization of another independent society.

There are no Water or Electrical Engineering Societies at present in Canada; therefore it seems evident that the members of these professions do not feel that the time has yet arrived when such institutions could be made a financial success. Those who wish to be in close touch with their work join either the British or American societies where they have the benefit of long experience and the use of the valuable collection of data and other interesting material which has accumulated through the years. These facts alone, to the young engineer, are sufficient to tempt him to join such existing societies.

How many municipal engineers are there in Canada at present? And what would their subscriptions amount to annually? I see no good reason why a branch of the British Institution of Municipal and County Engineers should not be formed in Canada. Perhaps it could be organized on the same basis as the new branch of the Royal Sanitary Institute in Vancouver. The proceedings of the municipal and county engineers are immediately available for members who join the branch, and they are especially valuable, since they are records dealing with municipal engineering problems from all parts of the Empire.

I am entirely in accordance with the suggestion contained in The Surveyor of October 17 and would like to see it carried into effect, as I feel it would be more successful than an independent institution.

Yours truly,
J. W. B. Blackman, City Engineer.

Contract Work for the City

Editor Contract Record:

I have read with interest your editorial articles, "The Gratuitous Bid" and "Competitive Tendering," published in your issue of November 12. Your arguments are calculated to appeal particularly to the building trade and our work is chiefly municipal, yet in dealing with the City Engineer's Department we have all the trials that you mention and we are compelled to bid upon specifications which are notorious for their unfair bids. Not only are we pitted against other contractors but we have to reckon with the City Engineer, who puts in a bid for every job and gets the contract if he is the lowest and wants the work; otherwise the next lowest tender is accepted, but only at the price submitted by the City Engineer.

If you are anxious to gather material for some constructive criticism and to do your part in instituting remedial measures, make yourself acquainted with the transactions of the Toronto city hall in regard to contractors. Find out just how the city regulates its costs of material and all such expenses as a contractor would have to bear. Do not overlook the fact that old material is used by the city—material which contractors may have removed from other works and hauled where ordered by the Department—possibly in the neighborhood of one of their so-called day labour jobs.

One of the complaints of the contracting community is that the City Engineer employs no inspector on day labour contracts; the foreman is entrusted with the whole of the contract; whereas in the case of the contractor's operations there is an inspector on the sub-grade, another on the concrete foundation, another on the curb and gutters, and yet another on the surface. Whatever the construction, the principle applies throughout. The engineer contends that his foreman has no reason to scamp the work, while the contractor may have, and yet the contractor is held responsible for the satisfactory conditions of the job for from five to ten years on his contract, with fifteen per cent. of the whole value held to ensure its maintenance.

In my opinion your idea of a Board of Arbitration is a good one and might be made to operate fairly in everybody's interest. Certain it is that the best interests of the citizens are not served by present methods. The specifications want overhauling badly and there is room for an examination into the city's methods of computing prices.

Yours truly,
"Fair Play."

Proposed System of Storm Sewers for the City of London, Ont.

Mr. Willis Chipman, of the consulting firm of Messrs. Chipman & Power, Toronto and Winnipeg, has submitted to the civic authorities of London, Ont., a report upon storm sewers which involves an expenditure of $392,000. He points out in the report that the central section of the city is now served by a system of combined sewers constructed prior to 1892, since which date, from time to time, a few drains have been laid for the removal of cellar water and street water without regard to any system. At present fully half the city is unprovided with storm sewers and the requirements in this respect are now urgent, the population having increased from 32,000 in 1892 to 49,000 in 1913.

At the present time the extent of the system is approximately as follows: combined sewers, 24 ins. diameter and larger, 14,800 ft.; combined sewers, smaller than 24 ins., 59,200 ft.; storm sewers, 24 ins. diameter and larger—none; storm sewers, smaller than 24 ins., 9,600 ft.; sanitary sewers, 18 in. and larger—none; sanitary sewers, smaller than 18 ins., 206,800 ft.; trunk sewers and three interceptors, 71,300 ft.; total 361,700 ft.

The total drainage area of the city is now 6,302 acres and the most important water course is Carling's Creek the total area of which within the watershed is 2,780 acres. The old business section of the city is drained on the "combined" system from three large brick sewers directly to the river. The dry weather flow of each of these mains in intercepted by the sanitary sewers constructed beneath them, specially designed adjustable openings being provided. If the interceptors become gorged the excess overflows into the brick sewers thence directly to the river outlets.

Flooding is reported in various sections and to overcome this Mr. Chipman recommends the construction of a large storm sewer on Colborne Street with branch sewers on Simcoe and York Streets.

The estimate of $392,000 is apportioned as follows: Carling's Creek area, $182,000; north area, $28,000; business area, $40,500; Hamilton Road area, $46,000;

London South area, $67,000; London West area, $28,500.

General Conclusions

The following general conclusions are given by Mr. Chipman in his report:—

(1) Retain the important natural water courses where practicable, as open outlets for the storm water, thus saving the expense of large conduits.

(2) Construct a trunk storm sewer in the valley of Carling's Creek from Waterloo Street eastward to Eva Street, the water course to be left open from Colborne Street to Maitland Street, and an enlarged culvert constructed at Richmond Street.

(3) In London South construct main Storm Sewers on Wharncliffe Road, discharging southward to Elmwood Avenue, and on Ridout Street, discharging at Carfrae Street.

(4) On Hamilton Road construct Storm Sewers from Maitland Street to Hyla Street, with four outlets.

(5) Relieve the central area by constructing a Storm Sewer on Colborne Street, with branches on York Street and Simcoe Street.

(6) Construct proper "catchbasins" and abolish the open "gullies" as rapidly as possible.

(7) Construct Storm Sewers at least one year in advance of laying down permanent roadways.

(8) Adopt an equitable frontage tax system for meeting part of the cost of the proposed works.

The following plans have been prepared in connection with the proposed storm sewer system:—

(1) General plan of city, scale 800 feet to inch, showing the sewers constructed prior to 1892.

(2) Skeleton plan of city, scale 800 feet to inch, showing the existing sewers.

(3) Topographical plan of city, on scale of 400 feet to an inch.

(4) Plan of city in sections, scale 100 feet to inch, in portfolio. These plans show all sewers constructed to date, with elevations.

(5) General plan of city, scale 800 feet to inch, showing proposed system of Storm Sewers.

(6) Plan of Carling's Creek, scale 100 feet to inch, showing existing Sanitary Sewers and proposed Storm Sewers.

(7) Profile of Carling's Creek, showing elevations of existing sewers and proposed sewers.

Sewage Disposal

In regard to sewage disposal Mr. Chipman reports in part:—

"The existing disposal works comprise three sedimentation tanks of 200,000 cubic feet combined capacity, and two bacteria beds each with an area of 15,000 square feet. These beds were more or less experimental, and when constructed it was the intention to add others year by year. Funds were not appropriated, however, and the total flow of the sewage was often discharged through the beds. They are now useless except as crude strainers for part of the effluent from the tanks. By removing or washing the filtering materials, the beds may be revived. Whether additional beds be constructed, or spraying filters, or trickling filters, is a matter for careful consideration, but some system should be decided upon before the pollution of the river attains a dangerous or offensive degree. Material alterations should also be made in the three tanks, to convert them into sludge removers rather than sludge digesters, and provision should be made for periodic removal of the accumulations of sludge, without pumping. Beds should also be constructed for drying the sludge."

Movable Concrete Chuting Tower

THE construction of the pneumatic-caisson foundations for the 38-storey Equitable Building in New York, will require about 12,000 yd. of concrete, besides about 8,000 yd. more of concrete in the interior piers, according to The Engineering Record. The caissons are built on the bottom of the preliminary excavation, about 25 ft. below the curb, and the concrete for them is mixed in three ½-yd. Ransome machines installed in three movable wooden towers 85 ft. high, that are located near the Pine and Cedar Street lines on opposite sides of the lot and on Nassau Street.

Concrete material delivered daily in wagons is chuted from street level to storage bins of 50 yd. capacity built in connection with the towers. The bins deliver by gravity to the charging hoppers of the mixing machine and the latter deliver to hoists in the towers, from which the concrete is distributed by the regular Lakewood system of suspended chutes to any point in the lot.

As a large portion of the area of the lot is covered by the caissons and piers it is difficult to locate the towers so that they will not interfere with some of the substructure work. They are, therefore, built, together with their storage bins, on horizontal timber sills, like skids, which enable them to be easily moved in any direction in order to clear or reach any given pier and then to be moved back again if necessary to clear or reach other piers.

The three plants have each a capacity of 40 batches of concrete per hour for the machine and for the hoisting apparatus, allowing for all reasonable delay. The apparatus has been installed by the O'Rourke Engineering Construction Company, contractor for the caisson and concrete work, from designs that are original and which are considered by the contractor to be most efficient.

ONE hundred persons are reported to have been injured more or less seriously in the collapse of a grand-stand at Greencastle, Ind. A football match was in progress and the enthusiastic rooters resorted to the swaying which proved such a popular innovation here a year or so ago and which is still continued spasmodically. It is not too late to direct attention to the fact that the inspection of these structures is not carried out as rigidly as it might be and that in many cases deterioration of some essential part of the structure has reached an advanced stage before it is detected. The changing tactics of the modern bleacher crowd bring with them an added measure of responsibility for the city building departments and the constructional interests.

The need for a cheaper method of excavation appears to have been supplied by Mr. John P. Risque, of Winnipeg. This machine is not only an excavator but is also a loader as the material is dumped straight into the waiting wagons. It is operated by a gasoline engine and can be moved about from place to place with ease. Its cost is said to be comparatively small. It is stated that whilst the average cost of excavating by hand is 30c a yard, the machine will do the same work at an expense not over 12c a yard. Its capacity is of 100 cubic yards a day and it weighs about 1600 lbs. One of these machines is at present in operation at the excavation for the new drill hall in Winnipeg.

Cost-Keeping for the Small Contractor

Value of a Simple and Easily Accessible System — The Forms Required to Maintain a Satisfactory Record of Labor and Material

By Chas L. Pitts, Toronto

THE most important item in the office work of any company, great or small, is to have an accurate and accessible system of costs: to be able, in a word, to tell exactly just how much it costs to manufacture a certain article or to undertake a designated work.

To the average small contractor, "cost" simply means the actual payment of cash for anything he may happen to buy. He neglects the fact that it is just as important for him to know, to a cent, what it costs to run his business as it is for the great construction company, with an international reputation to sustain, to know the exact cost of some gigantic undertaking. On costs depends the foundation of the contracting business.

To the small contractor the chief difficulty is in the general distribution of his work. In the absence of gang clerks, and, in common with most small contractors, acting as his own general foreman, he is too busy to handle any complicated system of cost-keeping; therefore, he must use some system which is not too exhaustive but accurate within a reasonable degree.

DAILY WORK AND COST CARD. WEATHER:

Foreman:
Location of Work: Gang No.

Material Received	Quantity	From	Cost per Unit
Brick: Lime: Gravel: Cement: Lumber:			

Material Moved	Quantity	To	Time and No. Men

Material Left Over:

Delays: Cause: Cost:

Completed Work:

Brick Laid:
Sq. ft. Concrete:
Excavation, Yds.
(How disposed of)

Remarks:

Total Cost of the Day:

Daily Card to be filled in by Foreman with the exception of the costs.

The most satisfactory method for the contractor with two or three gangs of men working in different parts of the town is to use the Daily Card system. This calls for the assistance of each Gang Foreman in the filling out of these cards. These cards are a daily record of the material received; number and time of men; material moved; delays for any reason; time of hired teams; time of owner's teams; weather conditions; amount of each different kind of work completed; material left over after the completion of that work, together with a column for remarks. These cards will vary with the general conditions, of course. To augment these cards there are the Order Books. It is well to remember that a foreman, in the hurry of the work, is apt to be in error with the order books, as has often been proved; therefore these books should not always be regarded as final in the event of a dispute; though, if a check be given to each teamster for each load, such mistakes will not be frequent.

The cards are filed under the heading of the street on which the gang was working and the order-book stubs are retained until the accounts have been paid. At the end of each month the cards are entered upon what is known as a Recapitulation Sheet. This is a monthly report in a brief form and shows which of the gangs has done the most work for that month, as well as the total cost of the work and the number of rainy days in each month. In brief, it is a monthly record of business.

The work of the small contractor may be divided roughly into four classes: first, material; second, labor; third, delays, and fourth, overhead expense.

Material received means more than, for instance, simply dumping a load of gravel and the final payment for same. It means the actual number of loads received on a certain date, where they were delivered, if any was left over, and, if so, where the surplus material has been removed to and the time it took to make that removal. If there are five loads of any material to be removed from one job to another, that is a charge against the work from which it was removed, because surplus material should not be brought upon the work.

Labor is the next consideration. If a gang of men are idle, or nearly so, for any length of time as a result of the non-delivery of material, or for any other cause, which, while not actually stopping the work, sends the men to some time-filling job to keep them on the work, then this is a charge against that work. If a gang of men doing any repair work or any work not tending towards the completion of the job, then this also is a charge against the work. Also, any work such as cleaning up, or repairing machinery, is a charge —in fact any work around the job not an overhead expense is a charge against that particular work. The only satisfactory way of keeping wages is to charge each man's time and rate as a separate account: not, for instance, "ten men, three hours," but one man, at so much, so many hours, and so on.

Delays are, of course, a charge against the particular work where such delay has been, unless the delay

No.	Date	No.	Date
Received from:		Received from:	
Article:		Article:	
For work at:		For work at:	

Foreman's order book. To give slip on receipt of goods.

has been caused partly by a piece of broken machinery, etc., then the cost of such work is charged to overhead expense, because it is too complicated, in a simple cost system, to charge machinery breaks to any particular account, as this machinery is used in all the work the contractor may have. Delay charges are, naturally, a part of the labor costs, inasmuch as they are usually caused by labor. It is well to know, though, in reckoning up a loss, just what has caused that loss—material, labor or delay.

Overhead Expense is any expense for the general up-keep of the business so distributed as to be impossible to charge to any particular branch. Office expenses, for example, are in this class; but tools, etc., though for the general use of the business, are not. This is a charge for the particular job they were bought for. Tools are sometimes lost or stolen and therefore the only way to keep track of this account is to charge it to the job. An Overhead Expense account is not deducted from the profit until a balance is taken at stated times.

CAR RECORD: (Sample for book to be ruled).

No.	Initial	Ordered	From	Placed	Test	Unloaded	Used at

Sample of Car Record Sheet for keeping track of cars. This sheet when filled in is a useful addition to such advice as the contractor receives from the shipper.

An accurate cost system is one in which the contractor can look back through his cards and price book —it is not always advisable to let the foremen know the exact cost of the material—and see just how much his material cost; the cost of the labor; the cost of the tools; the time of delays; the cost of repairs, the cost of extra work and where the charge for this work is to be placed; how much of his own time he has charged against each job; the cost by the foot, or by whatever measurement he uses in his business, and many other items in proportion to the perfection of his system and the care he uses. A cost system to be of use must tell the user how it is done and tell him in the shortest possible time.

MONTHLY OFFICE SHEET No. of idle days:

No. Gang	Location Work	Time on Work	Cost Material	Labor Cost	Tools Cost	Total Cost of job		Remarks
							Cost for Overhead Expense for the Month	

Total costs for all work completed, and total cost of all business for the month, including Overhead Expense.

Sample of Monthly Office Report. Profits are not usually placed on a sheet of this kind but are kept in the regular books.

In the exacting systems of the large contracting firms, there are car sheets, material records, time sheets, tool sheets, order forms, receiving blanks and a hundred-and-one reports. They get their costs to within a cent, but they pay large salaries for that knowledge. Such is not the system for the small contractor, because it is too expensive; but even the small contractor should know, within a dollar or so on the hundred, where he stands. He should know when a car is placed, when he ordered it, when it is unloaded, the number of the car, the cargo, and where he used the contents of that car. He does not want a car sheet for that: a ten cent book will do if properly ruled. At the end of each day he should have a fair idea of his profit or loss for that day. If he has lost he should know why; and if he knows why, possibly he can think of some way to avoid similar loss the next day.

Cost-keeping is not designed to do away with book-keeping. Its function, as its name implies, is to "keep the cost."

With an accurate cost system the contractor has his business in perfect control. Without it, the business controls him.

Work on the demolition of the old Union Station at Toronto commenced last week. It is planned to have the site cleared in time to commence excavation work as soon as the frost is out of the ground. The new building, plans for which are now completed, will be one of the most imposing railway stations on the continent. It will have a frontage of 840 feet. The plans were prepared by Mr. John M. Lyle, architect, Toronto, under the direction of a number of experts representing the Grand Trunk and Canadian Pacific Railways, the express and transport companies, and the Dominion and Provincial Governments.

Hopes are entertained of restoring to the perpendicular the great concrete tank elevator at Transcona. At present the huge tanks lie tilted, one side having sunk owing to the tremendous weight they had contained. As an indication of the strength of reinforced concrete, however, the tanks have remained intact and simply require the application of powerful jacks to keep the structures up whilst the foundations are strengthened beneath. It is estimated that it will cost about $30,000 to restore the structures.

Space-saving construction was exemplified in building concrete poles into the side of the No. 3 plant of the Aluminum Company of America, at Niagara Falls, N.Y. The reinforcing extends up to the side of the building, continuing to a point near the top of the pole, which is 10 ft. above the roof, and is braced to it by reinforced-concrete arms. This construction has permitted placing a spur track so close to the building that unloading and loading cars is greatly facilitated.

The Economical Planning and Designing of High Office Buildings*

THE engineering questions connected with the economical planning of the sky-scraping and ponderous office building of the present day appear, at first sight, to be so complicated in their nature and so involved as to make their logical solution a matter of great difficulty. Due reflection, however, coupled with careful analysis of their relative importance, will reduce these problems to comparatively simple terms; terms so simple, in fact, as to make a solution quite easy. Generally speaking, these questions embrace those items which have to do with the adjustment of size, shape, location and relation of parts, rather than with the appearance of those parts and are questions which, by a popular misconception of the true functions of the architect, are supposed to belong to the engineer.

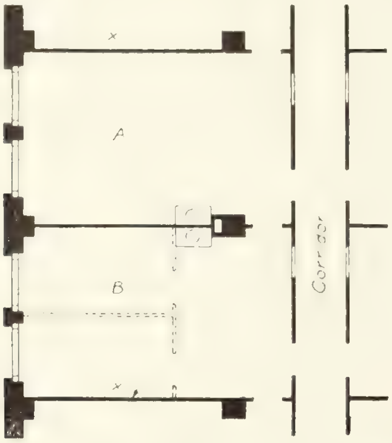

Fig. 1.—Typical unit-room and economical division of land.

Inasmuch as a typical building of this kind under construction will be wholly utilitarian in its purpose, the answer to these questions should be sought along similar lines, and it will be found that the economical plan is determined by the best disposition of the unit-room, while the height of the building depends upon the number of elevators which can be economically installed. In other words, the plan of the floor is determined by the unit-rooms of the floor, and the height by the space which may be economically set aside for reaching those rooms.

General Conditions and Requirements

As every investigation should be preceded by an exact definition of the thing investigated, it will be well to determine just what constitutes a sky-scraping office building, also the reason for its existence. An office building is one so planned as to afford conveniently arranged spaces in which numerous persons may transact, with freedom and dispatch, whatever business they may be engaged in—except the actual process of manufacture. Each occupant is to be provided with light—both natural and artificial—fresh air, water, heat, and such other requisites for his comfort and the conduct of his business as custom or wisdom justifies. Such a building is to be built upon ground whose value is relatively great and, by reason of the great cost of both land and building, it is generally financed by an assemblage of capital in corporate form. The reason for its existence lies in the desire for concentration within comparatively restricted areas, in the great cost of land within those areas, and the opportunity for economy due to what may be called the amalgamation of many buildings into one. When the value of the ground upon which it stands is great and the opportunity for revenue, by increase of tenantry, is large, it is raised high into the air, storey above storey, finally arriving at the distinction of being called a "sky-scraper." This extension of the height, however, causes a radical change in the construction. The low building (five to six storeys in height) is enclosed by walls of masonry, which not only support their own weight, but carry the loads imposed upon them by the floors and the roof. But when many storeys are added, the thickness of the lower portion of these walls—a thickness made necessary by the added load—becomes so great as to reduce materially the area of floor available for rental. Hence was devised the "skeleton construction," a steel frame in which the weight of the roof, the floor and the wall is concentrated upon and is carried by metallic columns to the earth, the thickness of the enclosing wall being only sufficient to afford a protection from the driving rain or from other elemental dangers.

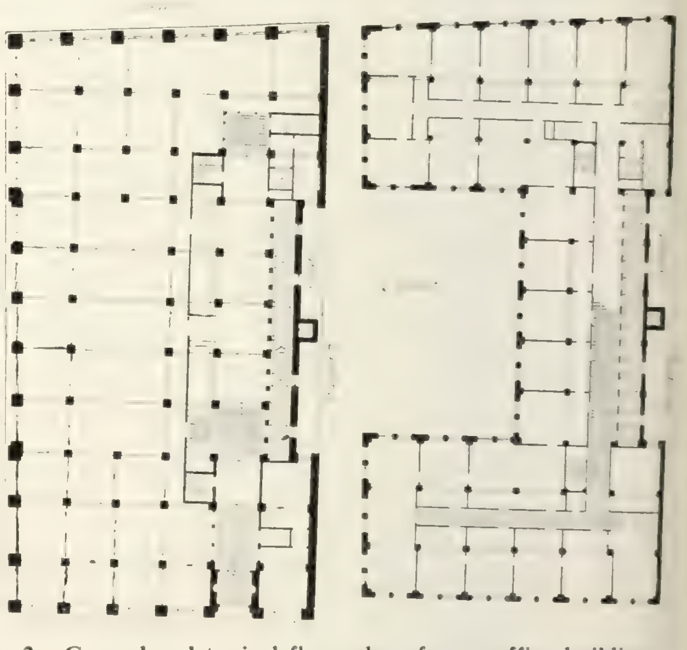

Fig. 2.—Ground and typical floor plans for an office building with streets on three sides and buildings on the fourth side.

Built as these office buildings are, as "business propositions," as investments for corporate funds, it is essential that they be built as economically as the stability, the durability, the requirements of their tenants and the custom of the day will permit. Moreover, as the return from the investment is wholly from rentals, it is essential that the buildings be so planned and constructed that the area available for rental is a maximum—a maximum, however, which has been fixed after carefully considering the requirements of light, air and approach.

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*By W. C. Hazlett, Architect, New York, in Engineering and Contracting.

Let us first establish the conditions of the plan—the conditions which are fixed by custom and by the desire of tenants. The first and second floors in buildings of this kind must be so planned that they may be let in large areas for stores, banks or similar institutions; and they must give (the first floor especially) ample space for the uninterrupted passage of the numerous tenants of the upper floors. Above these lower floors is a series of floors, divided, or capable of being divided, into rooms alike in size, purpose and value, each room in each storey being of equal importance. Inasmuch as the gross rental return from these upper floors is far greater than from the lower floors, it is more essential that the upper floors be planned to obtain a maximum return than the lower ones.

Size of Unit-Rooms

Persons experienced in dealing with the tenantry of such buildings agree that the size of the unit-room of these upper floors should contain approximately 350 square feet of rental area, their reason being that the number of persons willing to pay the five to eight hundred dollars—the sum demanded for rooms of this area in our larger cities—is greatly in excess of those willing to pay more. As the depth of such a room cannot exceed a maximum of 25 feet—due to the lack of natural light at a greater distance from the window—our unit-room has a maximum depth of 25 feet by a minimum width of 14 feet. For reasons which will appear later, the average size of this unit-room is 17½ feet wide by 20 feet deep. Experience has determined that 9 to 10 ft. is a satisfactory clear height, so that we find a unit-room of about 3,200 cu. ft. is ample for the five to six persons who may occupy it.

An investigation of the strength of the floorbeams and girders, considering the required loads, will show that they are economically stressed when arranged in bays to suit the size of the unit-room. Therefore a room having dimensions of about 17½ x 20 ft. not only meets the desires of tenants but also lends itself to an economical use of steel.

Fig. 1 (A) shows the type of unit-room, and Fig. 1 (B) shows the manner in which it may be subdivided.

Type of Construction and General Arrangement

As good practice will not permit the construction of buildings of this class to a greater height than 100 ft., unless fireproofed, and, as no building of less height could well be called a "skyscraper," we shall deal with fireproof construction in this investigation. As fireproof construction presupposes the use of fireproof floors, we shall deal with a combination of beams and girders having a filling of tile or concrete—plain or reinforced; this, in turn, being carried by interior columns. As the partitions which divide the unit-rooms should, for reasons of convenience and economy, follow the ranged lines of the columns it is essential that these columns be (in one direction at least) the same distance apart as the partitions.

As to the disposition of these unit rooms, it is almost self-evident that an arrangement of rooms on both sides of a central corridor is theoretically perfect. As the two rooms with the corridor and the enclosing walls and partitions will occupy a space of about 60 ft. in width, the typical plan will consist of an assemblage of wings approximating 60 ft. wide and enclosing or forming the sides of the courts. The space in the rear of the re-entrant angles of these courts—ill-lighted and therefore useless for rental—is used for stairs, elevators or for other purposes not requiring light.

Figures 2 (a) and 2 (b); 3 (a) and 3 (b); 4 and 5 are, respectively, the ground and typical upper floor plans of specific designs, for which a solution has been found. A careful study of these plans will show how the problem of getting the best arrangement has been solved in each of these three buildings.

The building represented in Fig. 2 is located on a plot fronting upon three streets, the light on one long side being obstructed by adjoining building. Fig. 3 shows floor plans for a building on an interior plot running through from one street to another, with the two long sides unlighted. The building represented in Figs. 4 and 5 is on a plot embracing an entire block, with streets upon four sides.

It will be noted how closely the solution of each specific problem approximates that which has been abstractly considered; the size of unit-room, with the corresponding economy in the use of steel; the width and disposition of wings; and the relegation of—what may be called the "machinery"—elevators, stairs, toilet rooms, flues, etc., of the building to the dark sides or to the rear of the re-entrant angles of the courts. The solutions shown are all quite possible, in fact, the only apparently logical solutions of the problems.

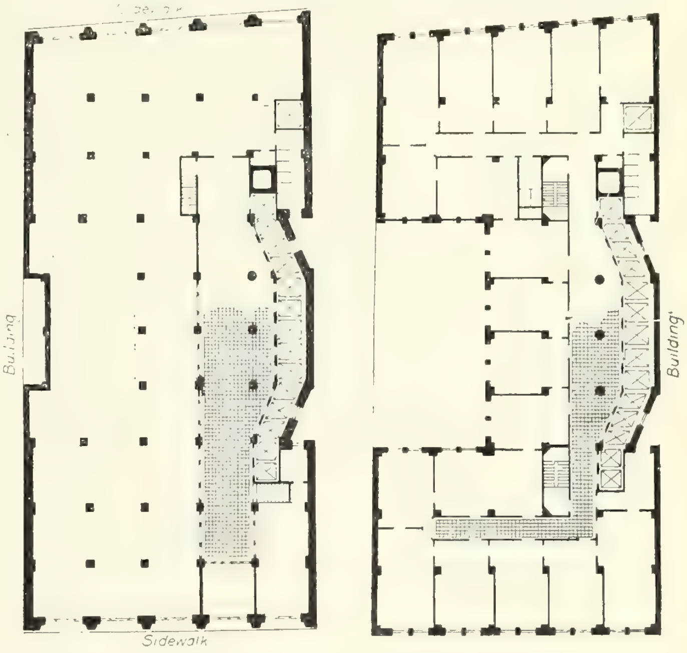


Fig. 3.—Ground and typical floor plans for an office building with streets on two sides and buildings on two sides.

In the case of the building noted in Fig. 5, the arrangement shown gives an actual net rental area (well lighted and available) of something over 61 per cent. of the area of the plot, while by no other disposition would such a large area be obtained. It is, of course, true that larger rental areas may be devised, but any space which lies at a greater distance than 25 ft. from the source of natural light (with the usual height of storey) will require artificial lighting and artificial lighting is costly, as it reduces the net return by the capitalization of the amount so expended.

It may be said in passing that the illustrative plans are not set down as models to be followed, but are given as "visible" examples of solutions arrived at under the stringent conditions imposed upon a designer by the requirements of tenants and by a desire for a maximum economy in construction. That satisfactory re-

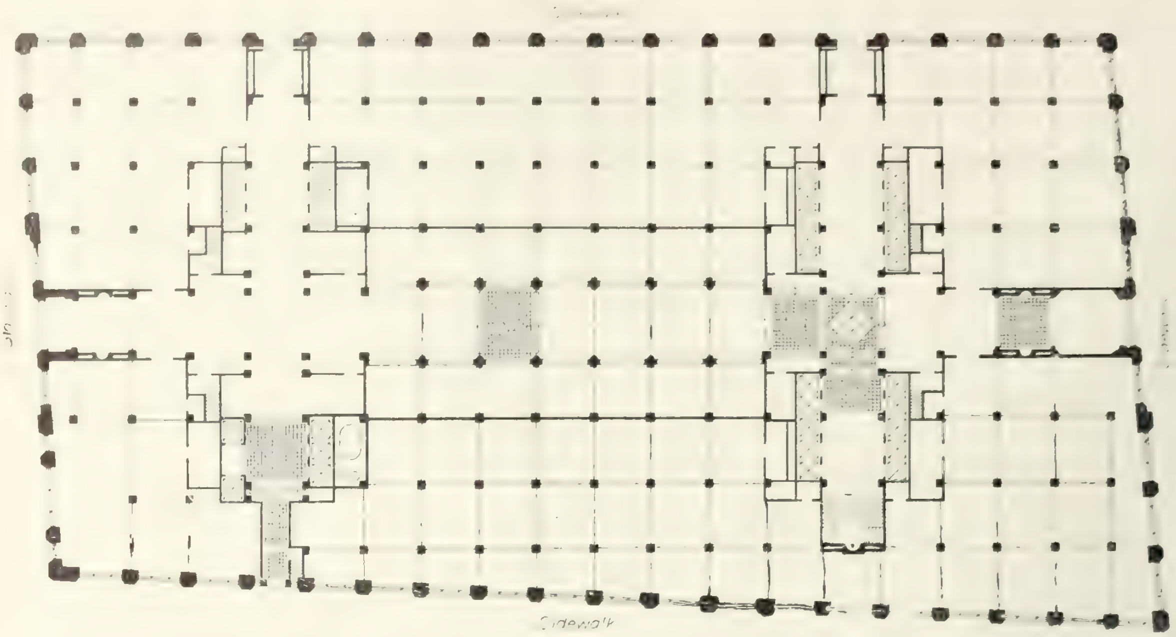


Fig. 4.—Ground floor plan for an office building with streets on all four sides.

sults may be obtained even under these stringent conditions seems self-evident.

Height of Building and Elevator Service

Having determined, in the manner and under the conditions already outlined, the general disposition of the plan it will now be necessary to fix the height to which the building can economically be built.

The height of buildings of this kind should not be determined in any arbitrary manner, but should bear some well determined ratio to the number of elevators which may economically be installed for the service of all floors above the first, the number of elevators being fixed, in turn, by the area which can economically be set aside for them. In other words, it is not wise to say "this building will be so many storeys in height," but, rather, "how high can this building be constructed, taking into account the otherwise unrentable space placed at the disposition of stairs and elevators?" The following answer is given to this question:

The best practice agrees in preferring, in a given space, a large number of comparatively small cars to a smaller number of larger cars. To be more specific, small cars are those having an area of platform of not more than 30 sq. ft. and accommodating, say, 15 people, This will give a car platform of 5 x 6 ft. and a shaft of, say, 6 x 7 ft. or, including the necessary grilles and dividing partitions, an area of about 50 sq. ft. If we have a known area to allot to elevators, and if we divide that area by 50, the quotient will be the number of shafts, or cars, which can be installed with economy. (In the planning of cars it will be well to arrange the

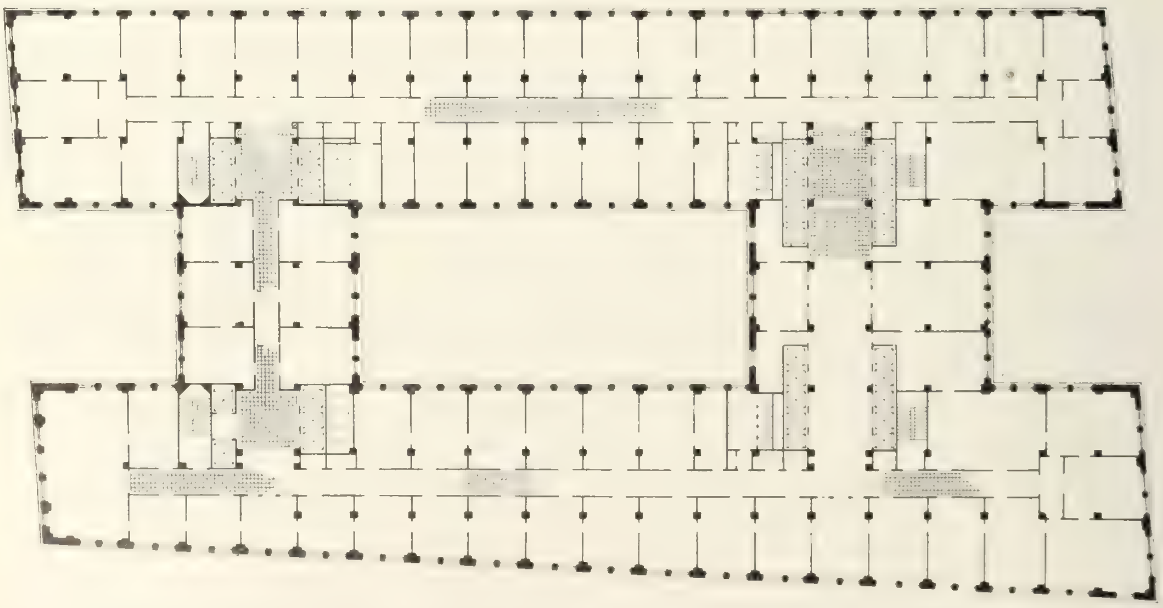


Fig. 5.—Typical floor plan for an office building with streets on all four sides—same building as shown in Fig. 4.

long side of the car adjacent to the landing, as this permits a greater width of door, it facilitates ingress and egress, and reduces the time required to fill or empty a car, the latter being one of the dominant factors for satisfactory service). With cars having a capacity of about 15 people, and with speeds and disposition of "run" as will be hereafter mentioned, the best present practice allows each car to serve about 15,000 sq. ft. of office space. By multiplying the number of cars (as above determined) by 15,000 and dividing the product by the number of square feet of rentable area in each storey, we may determine the number of storeys which can be served by these cars. This is the broad and general rule for determining the economical height of these buildings, although it is subject to various modifications to suit special conditions. For example, let it be supposed that one or more floors are to be occupied by a corporation employing a large number of clerks who arrive and depart at the same time; it is evident that the elevator service must be arranged to provide for this "peak" load, otherwise it will prove entirely inadequate.

Theoretically, perfect service demands that the time consumed in carrying any passenger from the ground to whatsoever floor he desires to reach, should, in all cases, be the same. This is, of course, impossible in practice; but the end to be sought is as close an approximation to this conditions as can be obtained. While the scope of this investigation does not permit a detailed study of the best manner of apportioning the run of cars, it will be briefly considered. The entire allotment of elevators is divided into a number of sections, one or more being devoted to what it called "express" service, the remainder consisting of "locals." The number of cars in each section and their speeds should be very carefully determined in order that the best possible solutions be obtained. For example, assume a building 30 storeys high, in which 30 elevators are installed. Ten of these might be allotted to "local" service from the ground to the tenth floor, inclusive; ten to "express" service to the tenth and "local" service to the twentieth floor; and ten, "express" to the twentieth and "local" to the top. The "express" cars might well have a speed of from 600 to 700 ft. per minute, while running "express," and a nominal speed of about 400 ft. per minute while running local. As the actual speed of any car while running "local" depends, in great measure, upon the storey height, the number of stops, and the facility with which passengers get on or off, it will be seen that the problem of apportioning service is, in practice, one of great complexity.

Inasmuch as the division of the elevator service into "express" and "local" sections permits the termination of the journey of certain sections at a storey far below the top, the space otherwise occupied by a car may be used for rental area. However, as the wise designer relegates his elevator service to the unrentable portion of his building, such a gain in rental area will be of little moment.

A brief return to the illustrative floor plans may prove illuminating. The elevator service, as there laid down, with its accompaniment of stairs, toilet rooms, flues, closets, etc. (the "machinery" of the building), can hardly be increased without encroaching upon well-lighted and available rental area, nor can it well be decreased, as the gain in rental area would be in a dark and unsatisfactory space.

Stairways and Elevator Shafts

Stairways, in this class of building, should be regarded solely as means of escape in case of fire or panic, and consequently may be placed in the dark and unrentable portions of the building. They should be proof against smoke as well as fire, and therefore should be enclosed in smoke-proof shafts with no openings other than self-closing doors. It would be well if these doors were distinctively marked, thus impressing themselves upon the memory of the tenant. These stair-shafts should have their exit at the street level into a large space set aside for the movement of tenants, with a direct and unmistakable access to the street. The consideration of these stairways as "fire escapes" and their consequent enclosure in shafts, will cause considerable economy in their construction, as it is only necessary that they be strong and durable. The bronze railings and marble fittings (so dear to the heart of the unthinking designer) may be used in other places—they are not necessary here.

It is also advisable that the elevators be enclosed in fire-and-smoke-proof shafts, similar in construction to those used for the stairways. The elaborate bronze grilles and costly wrought doors, commonly used as frontal adornments to these shafts, are not suitable for preventing the spread of a fire or the choking fumes of smoke or ammonia. A solid partition, with no openings except the necessary elevator door, is even more desirable.

Necessities and Conveniences

Buildings of this kind are also provided with artificial light, with heat, water, and with such other comforts and conveniences as are wise. The scope of this inquiry, however, does not permit a detailed investigation into these factors. It is sufficient to say that the use of gas—except in the stairways—is not customary and that the electric light is fed either from the Public Service Company's supplies or from the power plant installed in the building itself. In the latter case the building will be heated by the exhaust steam from this plant. Each office is provided with a wash basin, with cold (and sometimes with hot) water, while the various toilet rooms have the usual and necessary fixtures. Each floor should have at least one slop sink for the use of the cleaning force. Some system of vacuum cleaning is often found advisable and economical.

Maximum Height of Building

As an answer to the question of great popular interest "to what height may a building of this kind be built?" it may be said that there is no practical limit of height, provided funds are obtained with which to build it and tenants are found to occupy it. Given these essentials, there are no engineering problems with which the knowledge of the present day is not amply able to cope. In other words, if the funds are provided the engineer will produce a building for the possible tenant to practically any height desired. This answer applies more particularly to New York, where it is possible to carry the foundations to bedrock, which makes the foundation problem a comparatively simple one. In some cities the nature of the subsoil would be a governing factor in the design.

Cost of Office Buildings

The cost of buildings of this class and the opportunity afforded for an economical reduction of the cost are matters of interest and moment to the investor. As it would be useless to compare the gross cost of two buildings varying in size, scheme, and numberless conditions, or to predicate anything about gross cost, unless all conditions were known, such a comparison will not be attempted.

There is, however, a means of comparison—by the unit cost—which may be useful, and that unit has been, by convention, assumed to be the cost per cubic foot. In other words, we can safely compare the cubic foot costs of buildings if the conditions are known. In arriving at the cost, however (which cost is the gross cubic contents multiplied by the price per cubic foot), we must agree upon some method of determining the gross cubic contents. The following is thought to represent the best present practice: Multiply the area of the plot by the distance from the average ground level to a point 1 ft. above the lowest basement floor; add to this the cubic contents of the walk vaults, areas, etc.; then add to this sum the cubic contents of the building above the average ground level, omitting courts; the sum will give gross cubic contents.

The cost of these buildings may be further differentiated thus: Gross cost, which is the sum that the owner has expended at completion and which includes all fees, commissions, interest charges, taxes, etc.; and net cost, which is the builder's charge, including his profit and the designer's fee. Inasmuch as the difference between this gross and net cost depends upon many things with which the designer has nothing to do, we shall consider the cost—either the total cost of the building or the unit cost—as what has been called net cost.

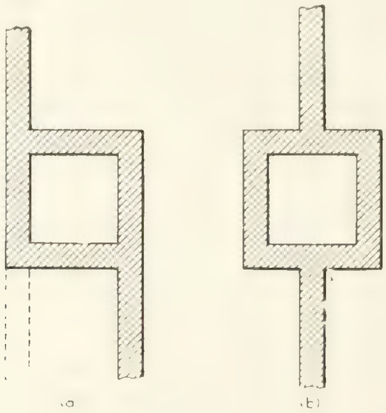


Fig. 6.—Arrangement of partitions at columns.

Without going into an exhaustive investigation of this matter and without quoting unverified data, it may be assumed that the cost of first-class buildings of this kind should not exceed 35 cents per cubic foot. By reason of a fortuitous combination of circumstances, this cost may be reduced to 30 cents per cubic foot. Perhaps 33 cents per cubic foot may be a fair working average, but no building of this kind should cost more than the first-named figure. It is quite true that many, in fact most, buildings have been built at a greater cost; but the reasons for this increased cost lie within the limbo of an economical and logical distribution of the plan, the structure of that plan, and the machinery which goes with it. The exterior finish of the building may greatly affect the cost, but we shall not further consider this item.

Opportunities for Economy

There is one opportunity for economy in the arrangement of the partitions which separate one unit-room from another, and the partitions which engage with the interior columns. Fig. 6 (b) shows the suggested arrangement. (See also the partitions marked "X" in Fig. 1 and the interior partitions shown in Fig. 3 (b). An inspection of Fig. 6 (b) shows eight angles about the intersection of the column covering and the partition, while Fig. 6 (a)—the suggested arrangement—shows but four. The interior rental area has not been reduced and the amount of partition or column covering has not been increased, yet this suggested change has worked a saving in the structure of between $8 and $9 per column per floor. A trifling matter, it may be said; trifling it is when compared with the total cost of the building, but when we consider 20 columns on 30 floors, a total of 600 columns, which will cost about $8 each, we see that there results a saving of about $4,800—an amount which the average owner does not consider to be "trifling."

There are numerous other opportunities for economy, apart from those herein mentioned, which will appear—after reflection and study—to the careful and appreciative designer who has at heart the material interests of his employer. While these items are apparently small, they will in their aggregate amount to so considerable a saving as to reduce the cost of a first-class building of this kind to the stated maximum of 35 cents per square foot instead of the 40, 60, 70 or even 80 cents per cubic foot, to which "dignity" some of them have arrived.

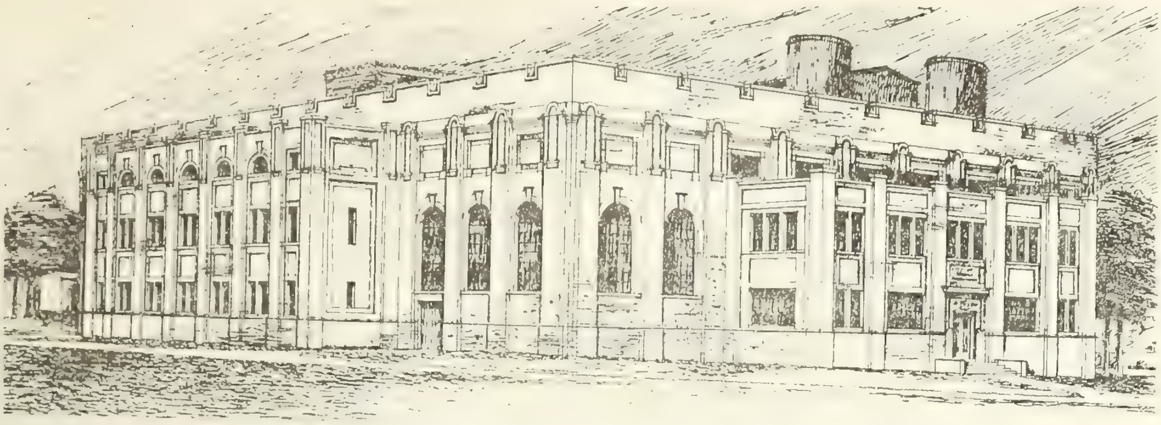
It should be remembered, however, that it is a far cry from economy to cheapness; that the latter, while apparently reducing the cost, will in reality increase it by adding to those repair bills which are alike a "curse" to the operating management and a "pain" to the employer. In fact, the path to true economy lies along those hard lines of painstaking effort, careful study of conditions, and laborious fitting of the means to the end—resulting, finally, in a structure which is a credit to the designer and a profit to the investor.

Concrete Protection in Salt Water

An outline of a special report, not yet given out by its author, Mr. W. B. McKenzie, right-of-way engineer of the Intercolonial, was presented at the recent convention of the American Railway & Bridge Association, held in Montreal. Mr. McKenzie stated that all along the part of the Atlantic Coast affected by frost concrete in salt water scales off between high and low tide, giving a figure of ½ in. per year as about the rate at which it chips off. The remedy proposed by him was a facing of salt-glazed vitrified brick, which is not affected by sea water. He would use hollow bricks with tongue-and-groove joints, so that the blocks could be laid, without mortar, under water, and would lock to serve as a form for the concrete. This facing would be continuously hollow from top to bottom, and additional openings 4 in. square in the back of each block would allow the concrete to flow in and bond the entire mass.

"Ferro-cement" is the name given to a new road-surfacing material that is reported in a contemporary as giving satisfactory service under automobile traffic in France. The material consists of a mixture of "iron straw," or threads of iron in a wiry or fibrous mass, with cement and sand. The iron is not a waste product, but is prepared by machines of special design.

During the ten months of the current year ending October 31st, the building permits issued at Vancouver represented an expenditure of $9,948,238, as compared with $16,319,162 for the corresponding period of 1912. The figures are supplied by Mr. S. H. Jarrett, building inspector.



Power house now being erected at a cost of $425,000 for the city of Regina.
Architects, Messrs. Story & Van Egmond.

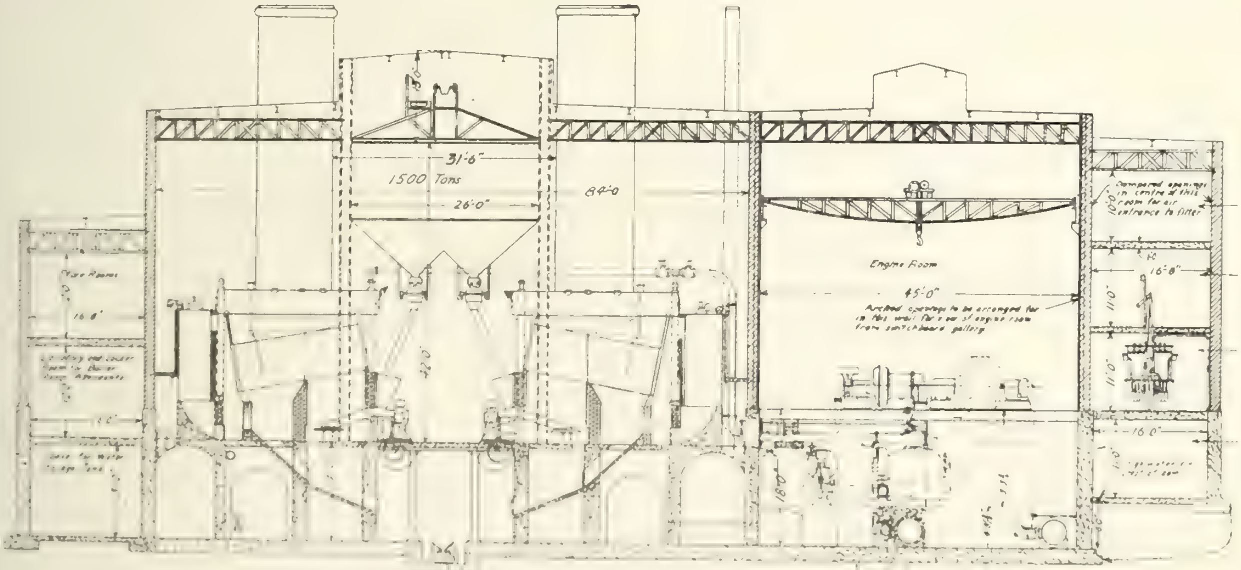
New Power Plant for the City of Regina

THE city of Regina recently desided to undertake the erection of a new power and light plant, at a cost of $425,000, the existing plant having become inadequate. Numerous improvements were desired, such as bunkers and carriers to facilitate the handling of the coal, also added facilities for the handling of ashes. The new power house, the erection of which has already begun, will be situated on the edge of Wascana Lake, within Regina city limits, and water from the lake will be used to cool the engines, instead of being drawn from the city mains as has been the practice under the old system.

The building itself, the foundations of which are now practically completed, will be 218 feet by 170 feet wide, covering an area of 28,000 square feet. When the work is completed and the new plant installed it is expected that the present rates for power will be materially reduced, The structure will be three storeys in height, of skeleton steel frame, enclosed with heavy red paving brick, trimmed with stone, the basement and foundations being of the same material. It will be fireproof throughout, and 68 feet high from the basement to the roof.

It has been necessary to remove 20,000 cubic yards of earth in excavating for the foundations, which contain about 6,400 cubic yards of reinforced concrete. Over 300 tons of structural steel will be used in the skeleton work of the building. The steel construction work is being done by the Western Steel Supply Company. The architects are Messrs. Storey & Van Egmond, of Regina.

One of the features will be the provision for visitors. Two special galleries overlooking the engine room are being constructed on either side of the switchboard room on the second floor. From these it


31'-6"
1500 Tons
26'-0"
84'-0
Engine Room
45'-0"
Arched openings to be arranged for in this wall for view of engine room from switchboard gallery
Dampered openings in centre of this room for air entrance to filter
16'-8"
11'-0"
11'-0"
16'-0"
16'-0"
18'-0"

Arrangement of equipment for Regina city power house, showing how coal is fed automatically to the boilers and the ashes forced out.

will be possible to obtain as unobstructed view of every machine in the room.

The most modern and economical stoking machinery is to be installed, so that there may be practically no smoke. This is the more remarkable in view of the fact that there will be a battery of 16 boilers capable of generating 8,000 boiler h.p., or practically twice that amount in electrical energy. There will be many other features to conserve human energy and make for general efficiency, including automatic stokers, ash conveyors, automatic coal conveyors, the latest type of machinery, tile-finished floor and walls in the engine room, concrete foundations for all heavy machinery (to prevent vibration), underground ducts for live wires, double wiring and piping throughout (so as to avoid delay in making repairs), a large electric traveling crane for lifting and placing heavy machinery, repair shop, up-to-date accommodation for all employees, and a chief engineer's office overlooking the engine and boiler rooms.

The chief engineer's office and permanent quarters will be another feature. It will be on the first floor at the west end of the building and will consist of office, three bedrooms, kitchen, toilet and a long gallery from which it will be possible to oversee both engine room and boiler room. Indicators in the office will keep the engineer constantly informed as to the exact condition of every machine, while telephones and electrical signals will give him instant communication with every workman in the building. In the same manner he will be able to control the old power house, which will be used as a sub-station. The kitchen in the engineer's quarters will be one of the most up-to-date in the city, as all of the cooking utensils will be electrical.

There will be two 1500-kilowatt steam-driven turbine generators, and in addition a 3,000 kilowatt generator of the same type. This, together with the machinery in the present power house, which will be left practically intact, will be sufficient to meet Regina's needs for some time to come. Ample room has been left for expansion.

Coal will be taken over the street railway lines in the cars in which it was brought to the city, weighed, and unloaded direct into the bucket conveyors, which will take it overhead to huge bunkers placed directly above each pair of boilers, having a combined capacity of 1500 tons. The bunker over each set of boilers will be separate, and when a new supply of coal is needed for any boiler a lever released by the fireman automatically discharges 200 pounds into the hopper of the Riley Automatic stoker. Every 200 pounds will be counted automatically, so that there will be a double check on the amount of coal used. The automatic stoker will feed the fire from underneath and in the same operation push the ashes and cinders away from the farther side. The ashes fall down a steep incline into the conveyors and are carried to the east end of the building where they are lifted about ten feet above the ground and there loaded into empty cars for removal.

As the coal is forced into the fire from underneath by the automatic stokers, a fan under the grate supplies the draft and the volatile, combustible parts are driven off and heated in their passage up and down through the coils which make up the boilers. In this passage the smoke-forming parts are mixed with air in direct proportion to the coal forced into the furnace, and as long as the adjustment remains perfect there will be no smoke. Economizers will be installed.

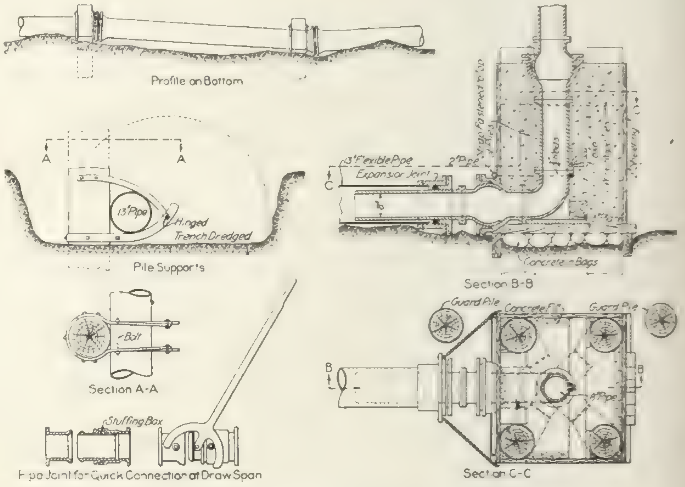
The boilers, like the piping and wiring, are so arranged that they can be cut off individually for the purpose of repairs without affecting the efficiency of the others.

Mr. E. W. Bull is superintendent of light and power at Regina.

Laying Submerged Water Main on Pile Supports at Richmond, B. C.

TO convey the water supply of Richmond, B.C., across the north arm of the Fraser River there was laid in 1911 a 13-in. submerged steel main with flexible joints, having a length of 1,200 feet. Richmond's water supply is furnished by the city of New Westminster and amounts to about 900,000 gal. daily. On account of the extremely uneven nature of the river bed, its continual shifting and the great number of water-logged trees and snags the pipe joints were not able to withstand the strain upon them and leakage finally increased to such a degree that it was impossible to maintain the required pressure. It was recently decided, therefore, to raise the 13-inch main and relay it on a level, protected support in the bed of the river.

In order to maintain Richmond's supply in the meantime an 8-inch wood-stave pipe was laid across a bridge at floor level. This necessitated arrangements for stopping the flow when the draw was opened. After drawing up tentative plans for joints of several types to be used at the drawspan connections, it was decided to use a device which had formerly been successfully employed on drawspan connections on a 2-inch main. This device consists of three brass castings, as shown in the accompanying drawing, one of which is movable and actuated by a hand lever. The movable part works through a stuffing box, its tip being machined to a cone shape which exactly fits the opposite casting so as to make a tight joint; the parts are spherically ground. In case the drawspan settles and the closure is slightly out of its normal position the cone shape of the connection brings the two ends of the pipe into line. This joint has been in use about six months and is said to have given excellent service without requiring repairs of any kind. The drawspan is opened on an average of about fifteen times a day.



Details of submerged water main with flexible joints at Richmond, B. C.

In order not to subject the pipe to water ram by the too sudden closure of the valve on the reservoir side of the draw, a blowoff is provided which discharges into the river. When the drawspan is to be opened the full flow of the main is first turned into the river, after which the valve between the blowoff and the drawspan joint can be closed with ease. The total length of the 8-inch wooden main on the bridge is about 450 feet, and it has been found that the insertion of this length of smaller diameter pipe in the 2½-mile length of 13-inch line has reduced the capacity only very slightly, as the principle of the Venturimeter tube serves to increase the velocity through the smaller section. This 8-inch wooden main with the drawspan connections will be left in place as an emergency reserve after the new submerged main is in use.

Brackets for Submerged Main

In preparing to relay the 13-inch main it was decided to use an agitator-suction dredge to excavate a trench directly across the bed of the stream. To insure further the rigidity of the pipe piles were driven in this trench 16 feet apart provided with metal brackets for clamping the pipe to the pile at the level of the trench bottom. In designing the bracket the requirements called for strength sufficient to carry the weight of the pipe to the pile if the river bed should scour from beneath and a fastening device capable of easy adjustment by a diver. The bracket used is so shaped, as shown in the drawing, that should the pipe settle on it slightly out of line the curve of the bracket would guide it against the pile, after which the upper arm would be swung into the closed position and spiked by the diver. The piles averaged 50 ft. in length and were driven about 11 ft. below the bottom of the channel. The brackets were affixed on the upstream side of the piles before driving, and in order that all might have the same level after the piles were driven a level instrument and observer were placed at a convenient point and driving was stopped when marks previously placed on the piles were down to correct elevation.

Troubles with River Current

While the piles were being driven the pipes had been bolted together and were supported on the under side of a long raft. When the row of piles was in place this raft was extended from shore on the upstream side. It was found, however, that the river current, which had a velocity of about four miles per hour, held the raft so firmly against the piles that it was required to use a tug, steaming full speed against the broadside of the raft, to free it from the piles. After considerable difficulty the raft was removed into place and the pipes were filled with water.

Chain pulleys had been provided to ease the pipes down to their supports, but the current held the pipe so firmly against the piles that it was even necessary to weight it down with bags of sand before it would sink. When it had sunk about 2 ft. an obstruction was found at the south end. It proved to be a two-armed snag that had come downstream during the night and encircled one of the piles; this was removed by the tug. Although only four and one-half days elapsed between dredging the trench and laying the pipe, soundings over the pipe disclosed the fact that the channel had silted up at the extremities of the trench to a depth of 4 ft., and the pipe was this far above the brackets on the piles at these points. This was not considered serious, however, as the brackets lie open beneath the pipe, and any scour of the river bed can only let the pipe down on its supports. After the pipe was lowered into the trench, the piles were cut off level with the river bed.

Because of the reduced pressure on bends, and because the full 13-in. section was not deemed necessary for the required delivery, the vertical pipes at each end of the submerged main are 8-in. in diameter instead of 13-in. The bends are anchored in concrete, supported on four piles, as shown in the drawing.

A crew of ten men was employed in transferring the main. Navigation to points up the river was stopped for four days. The work of relaying the submerged main was done by the city of New Westminster, under the personal supervision of Mr. J. W. B. Blackman, city engineer.—Engineering Record.

Building of Glass Twelve Storeys High

SOMETHING of a novelty in commercial buildings has been commenced at the corner of Tenth avenue and Thirty-sixth street, New York City. The architects, Goldwin, Starrett & Van Vleck, have provided plans for a twelve-storey skyscraper, in which the entire front of the building and its interior sides are to be of glass. In fact, 78 per cent. of the walls will be of this material. There will be no openings in the glass facade except those in the front of the building for emergency purposes, but which will not be visible from the street. Ventilation will be accomplished through a specially devised system of ducts, through which will be forced cooled and washed air, let into the offices at whatever temperature the tenants may desire. Humidity will be an unknown quantity, as it will all be washed out of the air, which will be cool, dry and free of all dust. In the winter season this same system will furnish heated air.

Vibration, usually noted in buildings where heavy machinery is operated, has practically been eliminated, and anti-noise has also received attention in other directions. All floors are to be rubber tiled.

It is estimated that the structure will cost approximately $600,000, of which amount $78,000 will cover the cost of the glass. On the interior the glass will be a specially polished plate, and for the exterior surface will be specially treated plate that will not transmit heat waves into the interior.

Rust Upon Paint

FROM experiments made by Dr. E. Liebreich and Dr. F. Spitzer, as reported in Die Umschau, it appears, says The Times, that the general opinion that rust in iron is prevented by a cover of paint is not always correct, and that in fact the paint itself may be the cause of rust. During the experiments made it was found that polished steel bars, which had been given one coat of paint, and upon which distinguishing numbers were painted, rusted principally, and in some cases solely, in the place where they might have been considered doubly protected—namely, under the thicker layer of paint at the numbers. Five colours were then selected, and some iron plates were given one coat and some four coats of paint, each coat being perfectly dry before the other was applied. These were exposed during 24 hours to a jet of steam. The places with one coat remained intact, the others were completely rusted. It is surmised that this result is due to the fact that the varnish of the second coat dissolved the paint of the lower one and thus made it porous, and that the porosity increased with the number of coats applied.

The Rationale and Advantages of Lime Sterilization of Water[*]

By Charles P. Hoover[†]

If it is the lime in water that makes it hard, then why add lime to water in order to soften it? The writer is asked to answer this question by about one-half the people who visit the Columbus Water Softening and Purification Works.

The proposition of course does seem absurd to those who do not understand chemical reactions, but nevertheless the explanation is rather simple and the writer wishes to explain the action that takes place when lime is added to water before going into the main part of the discussion, namely, "Lime Sterilization of Water."

Strictly speaking, it is not lime (CaO) that makes water hard, it is the limestone, calcium carbonate ($CaCO_3$) which is held in solution by the carbon dioxide (CO_2) which is almost always present in the natural water. Water impregnated with carbon dioxide (drawn from the air and from plant life) flowing over limestone rocks, dissolves and holds in solution the limestone. After this limestone gets into the water, there are several ways of getting it out, as follows:

First.—If the water is boiled, the carbon dioxide is driven off and just as soon as the carbon dioxide is expelled, the limestone is precipitated because it is not soluble in water free from carbon dioxide.

Second.—Quick lime, calcium oxide (CaO), has a great affinity for carbon dioxide and if it is added to water it immediately absorbs the carbon dioxide present in the water, is itself converted back to limestone and precipitates along with the rest of the limestone which has become insoluble because of the absence of carbon dioxide, so that when water is properly treated with lime, or in other words, when just enough lime is added to water to absorb its carbon dioxide (CO_2) content, the limestone or calcium carbonate is eliminated by precipitation.

Quick lime is limestone (calcium carbonate, $CaCO_3$) that has been burned in a kiln until all of its carbon dioxide content has been expelled. The reaction is as follows:

$$CaCO_3 + Heat = CaO + CO_2$$

Calcium carbonate or limestone — Calcium oxide or lime — Carbon dioxide

And when lime absorbs carbon dioxide, the reaction is simply the reverse:

$$CaO + CO_2 = CaCO_3$$

Lime — Carbon dioxide — Calcium carbonate or limestone.

If more lime is added to water than is necessary to neutralize the carbon dioxide, then the water will contain excess lime or caustic alkalinity. At the Columbus Water Softening and Purification Plant it has always been the policy to add lime in quantities just sufficient to neutralize the carbon dioxide and an additional amount to precipitate the magnesium which is always present in the Scioto River water. The utmost care has always been exercised to reduce the hardness to the lowest possible figure and still not leave residual or excess lime in the softened water. It has been observed that bacterial tests made for the presence of intestinal bacteria in the softened water collected from the outlet of the sedimentation basins are negative 92 per cent. of the time in 1 c.c. Therefore an investigation was made to learn just why the lime softened water was so free from intestinal bacteria.

Excess Lime Method

Dr. A. C. Houston, chemist of the Metropolitan Water Board of London, Eng., in the eight Research Report of the Metropolitan Water Board, proposed an excess lime method of sterilizing water. His conclusions were founded on his observations that quick lime, added to raw Thames water in proportion of 1 part of quick lime to 5,000 parts of water, kills B. Coli in 5 to 24 hours and the microbes also of epidemic water borne diseases, for example, the typhoid bacillus.

He proposed purposely to overdose a part of the water with lime so as to bring about a known bacterial effect and then after a suitable interval, to mix this portion with enough water adequately stored or sterilized with ozone or hypochlorite, to neutralize the excess lime. He states in his report that the excess lime is responsible for the germicidal action and that if just enough lime is used to neutralize the bicarbonate alkalinity of the water, no bactericidal action is effected.

Sterilizing Action not Necessarily Due to Toxic Effect of Lime

The results of bacterial tests made on lime softened water containing no excess lime, at the Columbus Water Softening and Purifying Plant, during the past four years and also the results of numerous laboratory experiments lead us to believe that the action is not necessarily due to the toxic effect of the excess lime, but that intestinal bacteria are killed when just enough lime is used to neutralize the free and half bound carbon dioxide in the water. Bacteria belonging to the colon or typhoid group seem to require carbon dioxide for their development.

If two samples of water, one containing CO_2 and the other free from CO_2, be inoculated with typhoid or colon bacilli, these organisms will live in the carbonated water but die in the water free from CO_2. This was demonstrated in the laboratory of the water purification plant in several ways, as follows:

First.—Samples of well water free from intestinal bacteria but containing free CO_2 were divided in two portions. One portion was boiled until all the CO_2 was expelled and was then carefully cooled so as not to absorb CO_2 from the atmosphere. The other portion was not boiled. Both portions were inoculated with typhoid and colon bacilli. These organisms thrived in the water that had not been boiled or in other words, in the water that still contained CO_2, but they died out completely in 48 hours' time, in water that was free from CO_2.

Even supplying the boiled water with oxygen did not render it suitable for sustaining bacterial life.

The results of these experiments tend also to support the contention that excess lime is not the essential factor in producing a water unfavorable to the growth of intestinal bacteria, because in this case, lime was not used to absorb the CO_2.

Second.—Samples of softened water collected from the outlet of the sedimentation basins and containing no free or half bound CO_2 were inoculated with from 5,000 to 10,000 intestinal bacteria per cc. and after 24 hours these samples became free from these organisms; on the other hand, organisms inoculated into softened water after it had been carbonated with CO_2 thrived and even increased in numbers.

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[*] Engineering and Contracting.

[†] Chemist in charge of Water Purification Works, Columbus, O.

Over 1,000 bacterial tests were made on samples of river water first inoculated with enough crude sewage to introduce from 3,000 to 8,000 colon bacilli and 40,000 to 50,000 total numbers of bacteria per cc. These samples after being inoculated with sewage were then softened with lime. Bacterial analyses were made after 5 and 24 hours' contact and in order to find out whether or not the bacteria were simply dragged down mechanically by the precipitated chemical, or were actually killed, samples of clear supernatant solution were tested, then the samples were vigorously shaken and a second set of tests made.

The results of these tests indicate that lime has a selective action. Intestinal bacteria are destroyed but the reduction of total numbers of bacteria is not high. Intestinal bacteria are killed and not simply removed by the precipitated carbonate, because the numbers of intestinal bacteria were no higher in the samples that were shaken than they were in the supernatant samples. Twenty-four hours' contact is not sufficient to insure sterilization of intestinal bacteria, unless the water is over-treated with lime.

Effluents from several sewage disposal plants were treated with lime. The results of experiments on sewage effluents show that excess lime is not necessary to effect the elimination of intestinal bacteria provided a sufficient period of contact is allowed (48 to 72 hours). The results also show that the action is not complete when large amounts of organic matter are present.

Many other laboratory experiments were made and the results of these experiments as well as the results of analysis of samples collected at different points in the plant seem to indicate the following conclusions:

Conclusions Based on Experiments

1. When enough lime is added to water to absorb the free and half bound carbonic acid and to precipitate the magnesium content, the bacteria of the colon and typhoid group are killed in 48 hours after being so treated, provided the water does not contain large quantities of organic matter.

2. The germicidal action is effective in from 5 to 24 hours when an excess of ½ to 1 grain per gallon is added beyond that needed to reduce the temporary hardness to the lowest possible figure.

3. Intestinal organisms will not live in water containing no free or half bound carbonic acid.

4. Lime softened water inoculated with typhoid organisms or with crude sewage soon becomes free from them.

5. The action is selective in that certain harmless bacteria grow but the disease producing germs do not.

Advantages of Lime Treatment

The intestinal bacteria and pathogenic organisms are killed by the lime treatment, rendering the water safe bacterially. The water is softened and soft water is more satisfactory than hard water for practically all purposes.

When lime is added to a water containing calcium and magnesium salts, a precipitate of calcium and magnesium hydrate is formed. The precipitated carbonate is pulverulent and is not a very good coagulant but the precipitate of magnesium hydrate is gelatinous and has about the same coagulating properties as the hydrate precipitates of iron and alumina. This gelatinous precipitate of magnesium becomes entangled with the precipitated carbonate, forming a gummy mass that settles very quickly. If there is no magnesium present in the water, a very small amount of filter alum, aluminum sulphate, added to the water will prove effective in hastening sedimentation.

The average turbidity of the river water treated at the Columbus water purification works, for the years 1910-1911 and 1912, was 63 parts per million. After being treated with lime, soda ash and alum the water was allowed to settle for about 12 or 15 hours and the average turbidity of the settled water was less than 5 p.p.m., and from June 1, 1912, to January 1, 1913, the turbidity averaged less than 1 p.p.m., the settled water being so clear that the filters were kept in service on several occasions for a period of seven days without being washed, and did not then show a negative loss of head. During the summer months, when the raw water shows a high average hardness, 250 to 350 p.p.m., and low turbidity, the clarification is almost perfect.

Turbid waters can be successfully disinfected by softening with lime and then allowing the turbidity to settle out, along with the precipitated carbonates. Turbid water has never been successfully disinfected with hypochlorite, because the bacteria imbedded in the suspended matter are not destroyed.

The sterilizing action persists indefinitely. In a recent paper on water disinfection by chemical methods, Mr. Samuel Rideal states the advantages of using chemicals that persist in their disinfecting action in the following words:

> It is at the same time a disadvantage, if a disinfectant, however powerful in its first onset, is very evanescent, as many disease germs are strongly resistant and we know that the time factor is of extreme importance in sterilization.

Lime Softened Water for Swimming Pools.—Since lime-softened water is a poor medium for the development of typhoid and colon bacilli, it appears to the writer that for use in swimming pools a water treated with lime in quantities sufficient to neutralize the temporary hardness and to introduce 2 or 3 grains excess lime would prove to be a very satisfactory and safe water for bathing purposes.

The advantage of caustic water over water sterilized with hypochlorite is that the disinfecting action of the caustic persists and if the water should become contaminated with pathogenic organisms they will soon become attenuated and finally die because there is no carbonic acid in the water and carbonic acid seems to be essential for their development, whereas a water sterilized by hypochlorite might be all right at the time of being pumped into the pool, but as soon as all the hypochlorite has become dissociated the chemical offers no resistance to the development of disease producing organisms that might be introduced into the water by the bathers.

Sterilization of Water Mains.—During the recent floods at Columbus it was necessary to stop pumping for a period of twenty-four hours on account of a section of 36-in. pipe being washed out by the flood water. The distribution system was drained and the local health authorities advised the people to boil the water, fearing that the mains would become contaminated with surface water. Knowing from our experiments that B. Coli, B. typhosus, B. para-typhosus, and intestinal bacteria will not live long in caustic water the method of treatment after pumping was resumed and was as follows:

The water at the plant was treated with enough lime to neutralize the temporary hardness of the water and in addition enough to introduce from 1 to 2 grains caustic alkalinity. Samples of water were collected from all parts of the city and 24 hours after the water taken from all parts of the distribution system showed by chemical tests the presence of excess lime or caustic alkalinity, the water was found to be bacterially pure. This treatment is safe, it does not introduce any taste into the water and there is no evidence except by chemical tests to indicate the presence of causticity in the water.

Metal Roofing as a Protection Against Lightning

By Professor E. S. Keene[*]

PROTECTION from lightning is a subject that recurs with the coming of each springtime. In the violence of an atmospheric electric disturbance, accompanied by the awe-inspiring flashes of lightning so common with the thunderstorms of the northwest, there are few who have not desired the protection of a lightning-proof shelter.

The probability of an individual building being struck by lightning is really very slight, but there is always a possibility of such an occurrence, and also that the stroke may be attended with considerable violence; more than that, the building may take fire.

That lightning rods are a real protection to buildings from lightning has been proven so many times that their value is no longer questioned, but the possibility of obtaining experimental data is so limited that definite rules for the establishment of the rods and conductors have never been formulated. For many years lightning rods were looked upon with suspicion in this country, because their sale for a considerable period was used as a means to defraud the unwary.

The formation of lightning is very imperfectly understood, but experience with its vagaries and a knowledge of the laws of high-tension electric currents has established a fairly good understanding of the methods of constructing lightning conductors for all ordinary discharges. It is very well known that lightning is the discharge of a large amount of electricity in a very short space of time and that whatever affords it a passage to the earth is apt to be badly damaged, unless the vehicle happens to be a good conductor of electricity and of sufficient size to transmit the amount of electric energy the flash contains; in which case it passes away doing no damage at all.

As a storm develops the electrically charged clouds pass over the earth, and when the electrical intensity becomes great enough to break down the resistance of the intervening air, the resulting discharge will pass into the earth by the most convenient path. This is commonly some high object of the landscape, a building, a pole, a tree or any other object that extends up from the earth. If the object is a conductor of electricity and connected with the earth, the lightning will pass into the ground without the least damage being done, but if it is not a good conductor, the havoc that is wrought in an instant is sometimes appalling.

Buildings with metallic roofs that are properly connected with the earth are far better protectors from lightning than could be given by rods. Buildings that are completely covered with sheet metal and well connected with the earth are practically lightning proof. Covered in this manner, buildings have been known to be repeatedly struck by lightning without the least damage. The sheet iron granary, when well connected with the earth may be considered lightning proof. The ground connections mentioned above may be made of metallic rods that extend well in the earth and are securely fastened to the metallic covering of the buildings.

If, then, the roof of a building possesses a metallic ridge, eave-troughs and downspouts, these will afford very good protection if they are well connected and well grounded. A roof covered with a metallic screen, as a chicken screen, makes an excellent protector when properly grounded.

It must be remembered that the ground connection is a positive necessity, and too much care cannot be exercised in its construction. The earth is the great reservoir of electrical energy and it is always at zero potential. If a discharge of lightning can be directed into the moist earth by a conductor, its energy is soon dissipated, but the ground connection must be of considerable area and extend well into the moist earth. A piece of galvanized iron pipe, driven into the ground seven or eight feet, makes a good "ground." Large buildings must have two or more such "grounds." The connecting wires must be securely fastened to the ground connections.

In the matter of conducting wires, the U. S. Weather Bureau, in a bulletin on "Lightning and Lightning Protection," recommends a No. 3 galvanized iron wire (Brown & Sharp gauge) as amply sufficient in size for ordinary lightning protection. If metallic downspouts are used as conductors the connections should be made, with the "grounds," with riveted joints. Copper conductors give no better protection than iron if the iron is kept covered to prevent it from rusting.

Wire fences are often the cause of damage by lightning because of the method of construction. If the fence wires are grounded the danger from this cause will disappear. Ground wires may be made of ordinary fence wire and should be connected with each of the wires of the fence and extend into the ground three feet. Such "grounds" should be made for each 100 feet of fence.

Valuable deposits of clay, especially adapted to the manufacture of tile, sewer pipe and high grade brick, have been discovered in the neighborhood of Vegreville.

An improvement in granite-block paving has been adopted in Philadelphia in the repaving of Broad street between Cumberland and Silver streets. The street was laid with granite-block paving of the old type with large blocks and wide joints. The old pavement was removed and the old blocks were cut in half and relaid with the cut end uppermost, and the joints between the blocks were grouted with Portland cement mortar. The pavement obtained in this way has a much smoother surface than the pavement originally laid, and the cost of the work was a little less than half the cost of laying a new granite-block pavement.

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[*] North Dakota Agricultural College, Fargo, North Dakota.

Reinforced concrete factory of T. S. Simms & Company, Limited, St. John, N.B.

New Reinforced Concrete Factory at St. John, N.B.

AMONG the new manufacturing plants recently put into operation in the Maritime Provinces is the brush factory of Messrs. T. S. Simms & Company, Limited, of St. John. This firm has been established in St. John for many years and has gradually built up one of the largest businesses in Canada for the manufacture of brooms and brushes. Outgrowing their old plant, the company was among the first to purchase a site in the new suburb of Fairville, and commenced building operations in the spring of 1912.

The main building, of reinforced concrete throughout, is four storeys in height, with a basement, and measures 52 ft. wide by 400 ft. long. The other buildings comprise a two-storey dry kiln 662 ft. by 52 ft., a boiler and engine house 70 ft. by 50 ft., with a one hundred and fifty foot chimney, and a one hundred thousand gallon concrete reservoir. The dry kiln and power house have reinforced concrete frames and hollow tile walls. Provision has been made in the layout of the plant by the engineers, Messrs. Lockwood, Greene & Company, of Boston, Massachusetts, for doubling its capacity when necessary.

As shown in the interior view, the ceilings are un-

The Simms factory under construction.

encumbered with beams, due to the use of the flat slab type of construction. The spacing of columns, about 17 ft. apart crosswise and 19 ft. longitudinally, affords a large area of clear floor space. The floors are designed for a live load of 150 pounds per square foot and have a granolithic finish, except in the woodworking department where a maple top floor is laid. The upper floors are reached by two stairways and two elevators, each well being completely enclosed by hollow tile partitions with automatic fire doors. The roof is formed over the ceiling of the top storey by a cinder fill graded to the proper pitch, and covered with a layer of cement on which tar and gravel roofing is applied.

Provision for the support of shafting, piping and other equipment is made by locating in the ceilings slotted inserts four feet on centres, similar inserts being placed in the floor in the basement.

The manufacturing processes carried on include everything necessary to convert lumber, broom corn and bristles into brushes, brooms and whisks, the material being received and shipped by rail.

Electricity is used throughout the plant for driving the machinery, for lighting, and even for heating the pitch. The motors are of the Canadian Westinghouse squirrel cage type, arranged on the group system. Open wiring is used on horizontal runs and conduits on vertical runs. Power is supplied direct by a Bellis and Morcom vertical compound engine, connected to a 188 kv.a. Siemens-Halske alternator which delivers three-phase energy at 600 volts, 60-cycles. Localized lighting by means of tungsten lamps is employed, the current being taken through transformers from the main generator. There is a small auxiliary direct current generator for supplying a few lights and for operating the heaters of the pitch kettles outside the regular working hours.

Steam at 125 pounds pressure is furnished by two 175 h.p. horizontal return tubular boilers. Some coal is burned, but a considerable amount of fuel is obtained from the waste broom corn, shavings, sawdust, and sweepings. A system of conveyors collects this material at various points throughout the factory and delivers it to the boiler room where it is automatically fed to the furnaces. Exhaust steam is utilized for the dry kiln and for heating the buildings which are equipped with the Dexter vacuum system.

An ample supply of good water is obtained from an Artesian well adjacent to the boiler house. For fire service, a one hundred thousand gallon reservoir, of reinforced concrete, is located in the yard from which the fire pump can draw its supply. Further protection is obtained by a 40,000 gallon tank placed on a structure above the roof of the main building.

The factory is thoroughly equipped with sprinklers throughout in order to reduce the fire risk as much as possible.

The contract for the buildings was executed by the Aberthaw Construction Company of Boston.

At a cost of over $500,000 a fine ten-storey building has been completed in Vancouver. The structure, which has been erected for Messrs. Henry Birks & Sons, jewellers, occupies a space 120 ft. x 102 ft. As little wood as possible has been used in the erection of the building, which is of fireproof construction, reinforced concrete and hollow tile being the material used. The exterior to the ninth storey is of light cream-colored terra cotta upon a base of polished British Columbian granite, the tenth storey and the coping and cornice being carried out in blue and grey terra cotta squares. In the interior, the entrance hall is finished in marble, with vaulted ceiling of Caen marble. Messrs. Summerhill & Putman, Vancouver, designed the building, the work of construction being done by the A. K. Bentley Company.

A Skyscraper of 1601

According to press despatches from Paris it has been discovered there that the originator of the "skyscraper" or gratteciel was not an American architect, but a Frenchman who lived three centuries ago. At the Bibliotheque Nationale there is preserved a volume written by this architect, whose name was Jacques Perret of Chambery, in 1601, describing a skyscraper of the author's invention.

"This grand and excellent pavilion, in which one can lodge 500 persons in comfort and luxury," was to be of 160 ft. frontage, 145 ft. in width and with walls 10 ft. thick. The edifice was to rise 12 storeys and have a little pavilion on the roof surrounded by terraces and was thus to reach an altitude of 350 ft., which," says L'Illustration, "is, of course, hardly to be compared with the gigantic buildings of 480 to 700 ft. which Pierre Loti saw on his recent visit to New York City. At the same time Perrat's design is certainly the design of the American skyscraper 300 years later—an audacious idea conceived by a Frenchman."

New Post Office for Westmount

WORK is now proceeding on a new post office for Westmount, P.Q., designed by Mr. Alphonse Piche, architect, of Montreal. The building will be situated at the corner of Western and Greene Avenues, having a frontage of 102 feet on the former street and 90 feet on the latter street. It is of classic design, with massive columns, dome and pediments. The foundations are of concrete and the exterior of cut stone on a steel frame. There will be two storeys and a basement, the upper storey affording accommodation for the caretaker. The ground floor is divided into various departments for the use of the officials. Marble and oak will be largely employed in the interior finish, the floor being mosaic. Mr. John Quinlan is the general contractor, the contract price being $104,000.

Sketch of Westmount post office now under construction.

The city of Birmingham, Eng., has purchased thirty motor omnibuses, 30 and 40 h.p., two-deck type, which will be operated as an adjunct to the municipal street railway system.

The Canada Building, Saskatoon

THERE are several points of interest in the design and construction of the Canada Building at Saskatoon, which has just been completed. The plan reproduced herewith is practically typical of all the other upper floors excepting the third which is laid out for doctors and dentists.

The interior finish of the building is the best that can be obtained. All corridors in the upper storeys are wainscotted to a height of 7 ft. with selected Vermont marble. The corridor floors are terrazzo with marble borders. The offices are furnished in quater-cut oak, stained "fumed." The woodwork of the corridors is selected Honduras mahogany.

The Canada Building, Saskatoon, completed recently.

There are three high-speed Otis-Fensom elevators serving the nine storeys, the elevator cars being expressly designed by the architects to harmonize with the rest of the finish of the lobby and corridors.

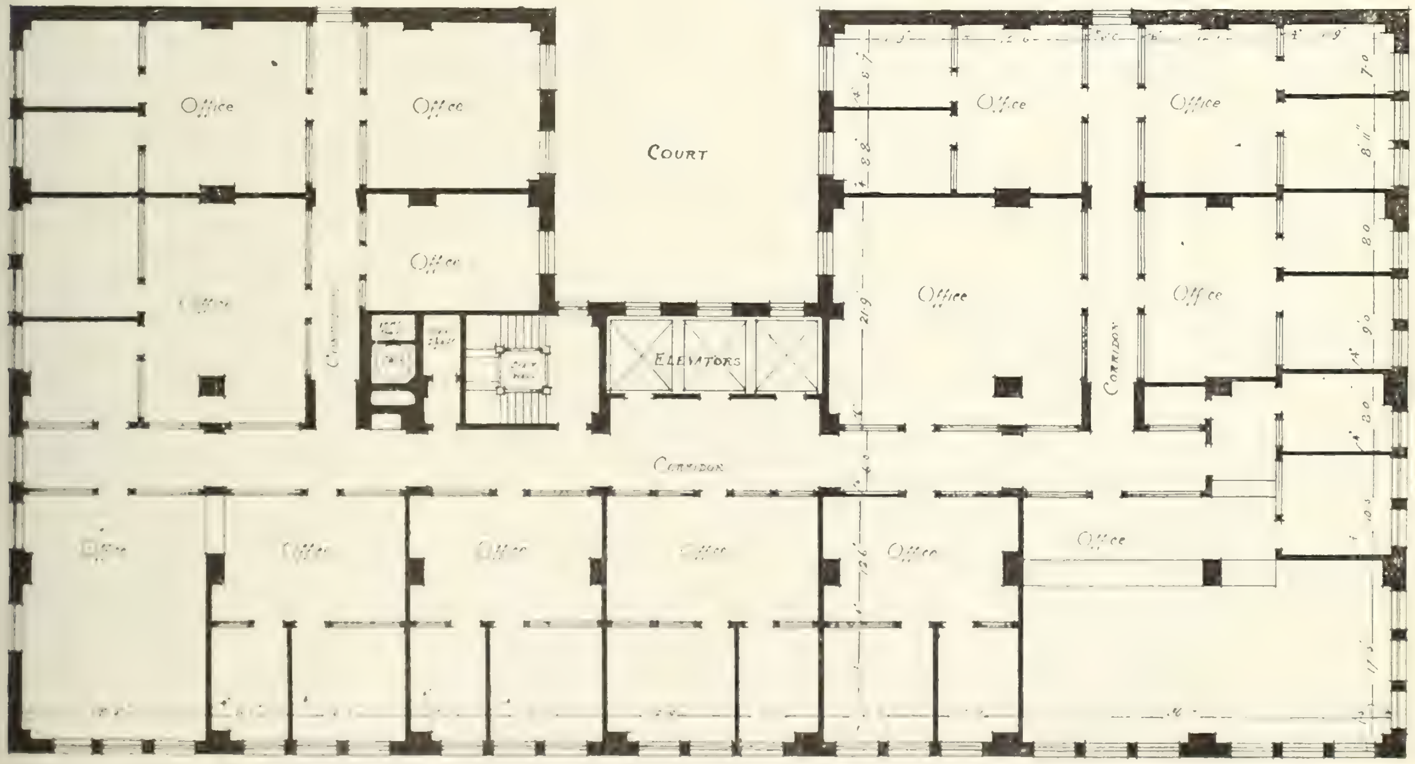
The entrance lobby is completely finished in marble, except the ceiling, which is heavily coffered and ornamented. The floor is pink Tennessee marble with a wainscotting of Botticino marble to a height of 9 ft. 6 in., above which, extend to the ceiling, panels of Pavanazzo marble, bordered with Tavernell.

The elevator fronts are of heavy ornamental iron. A beautifully ornamented stairway reaches from this entrance lobby to the second storey. From the centre of the celing hangs an electrolier of solid bronze 6½ ft. long and 3½ ft. wide, containing some hundred lights.

The public portions of the basement are finished in marble and Caen stone. The exterior is finished in ornamental terra cotta and pressed brick of the same shade. The store fronts all contain concealed awning devices, which, when the awnings are rolled up, show no trace of the device from the outside.

More than 500,000 tons of road material and loam are being unloaded from barges by a huge locomotive crane erected on the Panama-Pacific Exposition site at San Francisco and placed in freight cars for distribution. The engine handles material at the rate of 3,000 tons a day. It is estimated that more than thirty miles of perfect roads will be located within the main exposition grounds. The red rock is expected to fit the general color scheme, suitably contrasting with the exterior coloring of the exhibition palaces.

The Hotel Vancouver, at present being erected for the Canadian Pacific Railway, will be a building of sixteen storeys and one of the finest of its kind on the Pacific coast. The main portion of the structure will be of steel and concrete floor slabs, the base of the exterior of granite and the upper part of clay burnt brick and terra cotta. The work was designed by Mr. F. S. Swales. Messrs. Skene & Christie are the contractors.



Typical floor plan, Canada Building, Saskatoon.

Hydrated Lime—What it is and How it is Used

BY RICHARD K. MEADE*

Within the past few years "hydrated lime" has become a well-known term in constructional work. The following article, by an authority in the field, presents a comprehensive discussion of the part hydrated lime plays in the field of cementitious materials.

WITHIN the last few years the users of cement have heard a great deal about "hydrated lime." This is because, unlike quick-lime, it can be used with cement and when so used, confers upon the resulting concrete certain good properties, notably rendering it more nearly impervious to water, lightening its color and making it take a clearer impression of the molds and flow into the latter more easily. The question is therefore often asked by cement users: "What is hydrated lime?"

When a chemical compound is combined with water the chemist gives it the name "hydroxide" or "hydrate." Hydrated lime or lime hydrate is therefore a compound of lime and water. Thus we see that the name "hydrate" as applied to lime really means some property of the lime and is not merely an indefinite term, like the word "Portland" for example, which was applied to cement because the concrete made from it looked to the inventor like stone from the quarries at Portland, England.

Lime Putty

"Lime putty" or the paste resulting when lime is slaked in a mortar box is also hydrated lime. Chemically, there is no difference between the two. Practically, the difference is this. When the mason slakes lime in a mortar box, he adds to the contents of this sufficient water not only to combine with the lime, but also an excess; the latter remains after the lime is slaked and forms with the slaked lime a paste or putty. In the manufacture of hydrated lime, however, just sufficient water is added to slake the lime and what small excess is employed is driven off by the heat of slaking.

When lime slakes it merely combines chemically with water. Fifty-six parts of pure lime combine with 18 parts of water. These proportions are as fixed as the laws of gravitation. If we mix with the 56 lbs. of lime a little over 18 lbs. of water, the lime will take up only 18 lbs. of water, and, provided the quantity of water is not much greater than 18 lbs., the excess of this will be driven off by the heat generated when the lime slakes. If we use a great excess of water, say 50 lbs., the 56 lbs. of lime will still take up only 18 parts of water, some little will be driven off by heat and the rest of the water will remain mixed with the hydrated lime to form a paste or putty.

Hydrated lime therefore, is nothing more or less than dry slaked lime. In its manufacture, the quantity of water used to slake the lime is so regulated that the small excess over and above that needed by the lime is driven off by the heat generated in the slaking of the lime.

Manufacture of Hydrated Lime

In the process of manufacture used in this country, the lime is first crushed to the size of a pea. It is then introduced into a machine called a "hydrator," in which the water is added and the mixture stirred by means of paddles or plows until the lime has slaked to a perfectly dry powder. This dry powder is then generally passed through some separating system which removes from the fine powder all of the coarse pieces. These latter consist of unburned limestone, silicious cores and unhydrated lime.

The advantages possessed by hydrated lime over lump lime are numerous. There is, however, one objection to it, viz.: that it is not quite so plastic as lime slaked to a putty in a mortar box, hence many plasterers prefer lump lime. This is particularly true of high calcium limes. Masons and plasterers, however, are fast learning that the objection raised as to plasticity is more than balanced by the convenience with which hydrate can be handled.

When lime is exposed to the air it absorbs not only water, but also carbon dioxide and does what is known as "air slake." If water only were absorbed, the effect would be only to convert the lime into hydrated lime, but where carbon dioxide is absorbed the effect is to form carbonate of lime. Carbonate of lime and limestone are chemically the same thing and of course neither of them has any binding effect. In the formation of carbonate of lime, practically speaking, the lime reverts back to its original condition before its was burned. When lime air slakes the lumps break up and fall to a fine powder. If this powder is analyzed it will be found to consist of a mixture of carbonate of lime and hydrated lime and when tested will be found to have only a part of its original usefulness. Masons therefore formerly had a strong prejudice against fine lime. When hydrate first came out, it found much opposition, probably some of it fostered by the lump lime people, because its finely powdered condition led many to believe that it was air slaked lime. This prejudice has now disappeared, however, as hydrated lime is so extensively used that masons and plasterers are familiar with it and know the vast difference between the two—viz.: that air slaked lime is lime that has reverted to limestone and that hydrated lime is dry water-slaked lime.

Difficulty of Keeping Quicklime

The property which lime has of absorbing water makes it not only a hard but a dangerous thing to keep. It also requires an expensive package. Some lump lime is shipped in bulk but much of it, particularly the better grades, is shipped in barrels. Lime will keep much longer in barrels than it will in bulk, but even in these it air slakes rapidly and becomes worthless. Furthermore the barrels are expensive. Hydrate, on the other hand, may be shipped in paper, cotton or burlap sacks.

Hydrated lime is much more bulky than cement and consequently the sacks must be bigger. Instead of a bag 18 in. x 36 in. such as is used for 95 lbs. of cement, the burlap bags used for hydrated lime are generally 25 in. x 42 in. While, of course, a bag of hydrate is no heavier than is a bag of cement, it is much harder to handle, owing to its size. The burlap bags are so open that the hydrate dusts through them badly and while little of the material is actually lost, the handling of the burlap bags is hard on the men, consequently the introduction of cotton sacks within the last few years into the lime trade. These are made of much lighter goods than are the cement sacks.

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Keeping Quality of Hydrated Lime

Hydrate will absorb carbon dioxide if spread out in a thin layer. In sacks, however, which are piled together the loss of hydrate from air slaking is very slight. The outer layers of lime undoubtedly serve to protect the rest of the package. In some tests made of hydrate kept all winter in a dry storehouse, the loss was found to be on an average 3 per cent.; some of the outside bags showed as much as 5 per cent. and some of the inside bags as little as 1½ per cent. In the same length of time a lot of lump lime would have been rendered practically worthless.

One of the great advantages of hydrated lime is, therefore, its keeping qualities. This makes it especially desirable where only a small quantity of lime is used at a time, and over an extended period, allowing the user to purchase lime by the car load.

The lime industry is a seasonal one and generally the seasons are short. The lime manufacturer with kilns only is forced to shut these down when the trade is dull as it is in the winter. If, however, he has a hydrating plant he can run his kilns all the year around, storing his product as orders fall off and rushing it out when trade is brisk.

Fire Risk from Quicklime

The fire risk from storing quicklime is well known by lime dealers. A ton of lime on slaking will give as much heat as 75 lbs. of good coal. If water has a chance to get at the lime and any combustible material such as the barrels in which the lime is kept, the floor and sides of the lime shed, etc., is in contact with the lime, fire is very apt to occur. Many instances of the burning of sheds and storehouses in which lime was stored have come to the writer's attention. Sometimes the fire is caused by a leaky roof and sometimes by the rising water of a flood. Often leaky barges and boats carrying lime have been set on fire and burned at sea by the heat generated by the slaking of lime.

With hydrated lime there is no fire risk. Since the hydrate has once slaked it cannot slake again. It has the same relation to lime so far as ability to generate heat goes, as ashes have to coal.

Purity of Hydrated Lime

Generally speaking, hydrated lime is much purer than lump lime. This is particularly true of hydrates made by the air separator or the screen process, but is not true of hydrate made by the mill process. In hydrates made by the former process, the impurities are separated from the hydrate, while in the latter they are ground in with the lime. These impurities consist of silicious cores, unburned limestone and unhydrated lime, the latter usually occurring from the overburning and semi-fusing of the lime.

The silicious cores and the unhydrated lime are what cause the "popping" of plaster, the action being similar to the "unsoundness" of cement and from the same cause, viz.: the hydration and consequent expansion of the lime after the plaster has hardened. Where the mill process is used to make the hydrate, the cores are ground very fine and consequently can slake quickly and, if not present in too large quantity, before the mixture hardens. With a well made hydrate, therefore, the builder runs less chance of a bad job than with mortar often hastily slaked in the mortar box.

One of the strongest recommendations for hydrate so far as the user is concerned is unquestionably the ease with which it can be used. The builder is saved the expense of carting mortar boxes around. He is saved the delay of waiting for the lime to slake. He always has at hand slaked lime. The streets are not blocked by boxes and barrels full of lime paste. Instead of this, the hydrate has only to be mixed with water and sand and this can be done as well on the sixteenth floor of a sky-scraper as on the ground. For brick and mortar work, it is hard to conceive of any mason using lime putty when the ease with which hydrate can be made into a mortar is considered. Hydrate is particularly well adapted for "patching jobs" and to rush work.

One of the strongest claims for hydrate is the fact that it can be used with cement. It is only necessary to mix the two and any desired proportions can be employed. For laying brick and stone a mixture of 25 parts cement and 75 parts lime is quite popular. (One bag of cement to three 100-lb. sacks of hydrated lime). The addition of the cement does not appreciably detract from the plasticity of the mortar, while it adds greatly to the strength, particularly at early periods. For stucco, the proportions are generally reversed, (one 100-lb. sack of hydrated lime to three sacks of cement), the hydrated lime adding to the plasticity of the mortar and making it spread more easily. It also makes a lighter colored stucco and adds to its density. For waterproofing, about 15 parts of hydrated lime and 85 parts of cement are used, (or one 40-lb. sack of hydrated lime to two sacks of cement).

The addition of hydrated lime to cement mortars acts as a sort of lubricant and causes the latter to flow more readily and to fill the forms and molds more perfectly. It also causes the forms to leave the concrete more cleanly.

Hydrated lime, however, delays somewhat the set of concrete in which it is used and such concrete will not harden quite so rapidly as will plain concrete. It may often be used to retard the set of quick-setting cement.

Much has been said about the water-proofing properties of hydrated lime and concrete in which it has been used is certainly more resistant to water than where it has not been employed. In the laboratory, concrete made with hydrated lime shows quite a high rate of absorption when immersed and, if the Chapman block test is applied to cement-hydrated lime mixtures, these show some improvement over cement alone but still show that water will be soaked up quite rapidly by such concrete.

On the other hand, hydrated lime in practice has given good results and in my estimation the reason for this is found in the fact that mortars in which hydrated lime is used flow very freely. Consequently they may be worked in around the aggregate thoroughly and along the face of the forms, resulting here in a surface similar to the trowelled top of a cement sidewalk. For making tanks, pits, etc., watertight, hydrated lime will give excellent results. It is not, however, an infallible remedy against damp walls, etc.

Hydrated lime should not be used in concrete subject to sea-water as the writer's experiments show that concrete in which hydrated lime is used is more subject to attack than plain concrete.

Glossary of Terms Used in Road Construction

(Continued from last issue.)

Gabbro.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Ganger.—The foreman of a gang of labourers.

Gangmaster.—One who hires a gang of men to perform some specified work.

Gangway.—A temporary bridge or access usually constructed of wooden planks.

Gantry.—See "Gauntry."

Garbage.—A word sometimes applied to house refuse.

Gas Tar.—The tar which condenses in the pipes, etc., when gas is distilled from coal.

Gauge.—A standard of measure. The term "gauge" has been adopted by the Engineering Standards Committee to designate the standard group of sizes into which broken stone has been divided, and the term "size" has been adopted for the sub-division of the "gauge."

Gauging.—The act of measuring or dividing into sizes.

Gault.—A stiff marl or calcareous clay.

Gauntry.—Sometimes spent "Gantry." A species of crane or hoist.

Gelatinous.—Resembling jelly; viscous.

Glutinous.—Viscous, viscid, tenacious, resembling glue.

Glutrin.—The trade name of a material for binding in carriageways.

Grab.—A description of dredger or machine for removing soils.

Grade.—Sometimes used instead of the word gauge.

Grade Line.—Sometimes used to describe the line of gradient

Gradient.—The longitudinal degree of slope, inclination, or fall of a road. Sometimes wrongly called the "grade."

Grading.—A term used to indicate the shaping of a road when under construction. Also used to describe the sorting of materials according to their sizes.

Graduate.—"To prepare gradually; to temper or modify by degrees."

Grafting Tool.—A sharp, narrow spade used for digging clay.

Grain.—The veins or fibres of wood, etc.

Gramme.—The French standard unit of weight equals 15.4325 grains Troy.

Granite.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee. Used also as one of the rocks coming under the group.

Granolite.—The trade name of an artificial stone.

Granomac.—The trade name of a bituminous macadam.

Granophyre.—Comes under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Grant-in-aid Roads.—Certain district roads, towards the maintenance of which county councils make grants to district councils.

Granular.—"Consisting of, or resembling, granules or grains."

Granulite.—Comes under the trade name of "granite," as settled by the Engineering Standards Committee.

Grating.—A frame of iron bars covering a gully or other opening; sometimes also called a "grid" or "grate."

Gravel.—Small stones or fragments of stone, or small pebbles, generally much water-worn, often intermixed with sand, clay, loam, etc. This material is generally known as rover-gravel or pit-gravel. The Engineering Standards Committee have not yet dealt with it.

Greasy.—Used to describe the surface of a carriageway when under certain climatic conditions it becomes slippery.

Greedy.—Used to describe a stone or other substance which imbibes a large quantity of bituminous liquid. For instance, a limestone may be described as "greedy of tar."

Green.—Fresh or new.

Green Oil.—See "Anthracene."

Greenstone.—Comes under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Grey Royal.—The trade name of a special granite sett.

Greywacke.—Comes under the trade name of "Grit," as settled by the Engineering Standards Committee.

Grid.—See "Grating."

Grip.—A cutting or trench provided at the side of the road to drain off the surface water. Sometimes called a side grip. Also used to describe the "hold" of a horse's hoof on a carriageway.

Gripmac.—The trade name given to a manhole cover which, it is claimed, retains the road surface against the frame.

Grit.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee; sand or gravel of rough but small, hard particles, used for "gritting" or "sanding" the surface of a carriageway.

Grout.—Or Grouting. As a verb this word is used to designate the act of filling either joints or interstices with a bituminous or cementitious mixture. As a noun it is used to describe the mixture or material used for the purpose of grouting.

Growing Soil.—Sometimes used to designate the actual soil of a foundation.

Grub.—Or Grub Up. To dig up by the roots, or root out by digging.

Guide Post.—See "Signpost."

Gully.—An opening in the channel or water table at the side of a carriageway to take the surface water. (A gully is really a channel, and it should be called "gully hole," or "gully pit.")

Gummy.—See "Viscous."

Gunter's Chain.—A measuring chain of 100 links of 7.92 in. each equals 66 feet in length.

Gutter.—See "Channel.

Guy.—A rope used to steady a shear legs or other similar erection.

Hacking.—See "Scarifying."

Haft.—A handle.

Ha-Ha.—A sunk fence or ditch.

Hahnite.—The trade name of a dust palliative.

Hairpin.—A term used to designate a very sharp and complete turning (like the head of a hairpin) in a road.

Halt.—A stopping place or station on a light railway.

Hand Broken.—Stone broken by hand with a hammer.

Hand Pitched.—A term used to designate a foundation, or bottom, or bottom course, of a carriageway constructed of large stones, placed carefully by hand.

Handspike.—A bar of wood used as a lever.

Hanging Road.—A road with a crossfall from one side to the other, and not higher in the centre.

Hardcore.—Materials, such as brickbats, clinker, rubbish, etc., used for the bottom course or foundation of a carriageway.

Hardwood.—A generic term for a wood that can be used for paving without any previous treatment, to distinguish it from softwood.

Harsh.—A term sometimes employed to designate a rough and hard surface of a carriageway.

Haunches.—The sides or flanks of a carriageway; sometimes also called "quarters."

Hectare.—A French measure containing 2.4711 acres.

Heel.—A term applied to that part of a footwalk which is furthest from the kerb.

Herring Bone.—A term applied to a method of paving obliquely to the left and right alternately.

Highway.—A generic term to include the whole road between the hedges or walls. "A public road, a way open to all passengers."

Hogback.—A convex hill, similar in shape to the back of a hog.

Hogging.—A name sometimes given to a red marly gravel, used as a binder.

Holding.—A tenure.

Homogeneous.—"Of the same kind or nature; consisting of similar parts, or of elements of the like nature."

Hopper.—A funnel or receptacle.

Hornblende Schist.—Coming under the trade name of "Hornfels," as settled by the Engineering Standards Committee.

Hornfels.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Hornstone.—Coming under the trade name of "Hornfels," as settled by the Engineering Standards Committee.

Humid.—Moist, damp, containing sensible moisture, wet or watery, consisting of water or vapour.

Hummock.—A rounded hill or small hillock.

Hygroscopic.—Having the property of imbibing moisture from the atmosphere.

Imbricate.—To overlap. Sometimes used to designate the overlapping of the finished surface of a carriageway so as to prevent an edge being left.

Immerse.—To plunge or dip anything into a liquid so that it is completely submerged.

Immobile.—Incapable of being moved.

Impalpable.—Incapable of being felt by touch, such as very finely-ground cement.

Impenetrable.—Incapable of being penetrated.

Impermeable.—Not permitting the passage of a fluid; waterproof.

Impervious.—Sometimes used instead of "impermeable."

Imponderable.—Without weight.

Impregnate.—To infuse or saturate. Creosote, for instance, is infused into soft-wood paving blocks.

Inadherent.—The state or quality of not being capable of adhering.

Incline.—An ascent or descent.

Incorporate.—To mix or blend.

Incarnate.—To make thicker.

Indentation.—A depression sometimes applied to the track or hollowing made by a wheel.

Indissoluble.—Incapable of being dissolved.

Indivisible.—Not capable of being divided.

Indurate.—To make hard.

Inert.—Sluggish, inactive.

Infiltration.—Slow penetration of moisture.

In Situ.—The exact place, or on the spot.

Insoluble.—See "Indissoluble."

Instable.—Liable to give way; changeable.

Interattrition.—Used to designate the movement of the stones composing a carriageway amongst themselves, due to the movement set up by the traffic, thus causing an attrition or grinding action among the stones.

Interstice.—A space intervening between one body and another, otherwise in close connection. The word "interstices" is used to describe the voids or spaces between the broken stones of a carriageway, etc.

Invert.—An arch reversed or turned upside down.

Ironstone.—Coming under the trade name of "Limestone," as settled by the Engineering Standards Committee.

Islet.—Sometimes used to designate a refuge or place of safety for pedestrians on a carriageway.

Jarrah.—An Australian hardwood used for paving.

Jodelite.—The trade name of a preservative for wood blocks.

Journals.—The ends of shafts of an engine resting on bearings or enclosed by couplings.

Jumper.—A long iron chisel used for boring holes in rocks.

Karri.—An Australian hardwood used for paving.

Keck.—To tip a cart or wagon. A "kecking beam" is used to back against when tipping.

Kennel.—The watercourse or gutter of a street. See "Channel."

Kentish Rag.—A dark, tough limestone.

Keratophyre.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Kerb.—Sometimes spelt "curb." The stone or other material used at the sides of a carriageway to support the footway.

Keroselene.—A volatile hydrocarbon which first passes over when petroleum, coal tar, etc., are distilled.

Kerosene.—A liquid hydrocarbon distilled from coal, bitumen, etc.; closely related to paraffin oil.

Kettle.—A pot or boiler in which bituminous mixtures are heated.

Keyed.—Held together by a bond.

Kidney.—The name given to small, rounded, water-worn boulders, formerly much used for paving.

Kilogramme.—A French measure of weight equal to 35.27 oz.

Kilometre.—A French measure of distance equal to 1093.6 lineal yards.

Kiton.—The trade name of a bituminous binder.

Lagging.—The planks supporting the bricks, concrete, etc., in tunnel work. Also the non-conductive covering of boilers, steam pipes, etc., to prevent radiation of heat.

Lamina.—Thin scales or layers.

Lamprophyre.—Coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Landers.—Temporary troughs of wood for the conveyance of water, sewage, etc., during the construction of works.

Lane.—A narrow way or passage between hedges, walls, or buildings.

Larch.—A softwood much used for paving.

Larry.—A wagon, sometimes called a lorry.

Lateral.—"Pertaining or belonging to the side," or "Proceeding from the side," such as lateral branches, lateral roads, etc.

Latten.—A thin lath.

Launder.—See "Lander."

Layer.—A word sometimes used instead of "course" or "crust," etc.

Lay-out.—The planning or alignment of a net-work of roads, etc.

Leat.—A trench or conduit of water to or from a mill.

Lifting.—The act of raising the surface of a carriageway by pickaxes or by a scarifier; also called "chequering," "scarifying," "hacking," "stocking."

Ligneous.—Made of wood.

Limestone.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Lithofalt.—The trade name of a compressed paving block of an asphaltic or bituminous composition.

Lithomac.—The trade name of a special method of mixing and laying an asphaltic macadam.

Litre.—A French measure of capacity equal to 61.028 cu. in.

Litter.—Sometimes used to designate dry rubbish on roads.

Loam.—Native clay mixed with sand or lime, or decayed vegetable and animal matter.

Longitudinal.—Lengthwise, as opposed to transverse or across.

Lorrie.—A long open wagon. Sometimes spelt "lorry."

Lyantine.—The trade name of a process of making carriageways.

Machine-broken.—Used to denote stone that has been broken in a machine, and not by hand.

Macadam.—A generic term used to describe a method of carriageway construction with broken stone, gravel, etc., bound together with smaller stone, gravel, etc., and water; also used to designate the broken stone or metal of which a carriageway is formed. (The word is derived from the name John Loudon Macadam, one of the first men since the days of the Romans to construct roads on scientific lines).

Machine-breaker.—Sometimes used instead of "stone-breaker" or "stone-crusher" to designate a machine for breaking stones.

Magna.—The trade name of a special granite sett.

Main Roads.—A rather loose term, but now generally applied to roads maintained by county councils.

Malm.—A rich soil resting on the upper green sand.

Malm Brick.—A yellow sandy brick.

Manjak.—Pure bitumen.

Marbit.—The trade name of a bituminous binder or dust palliative.

Marble.—Coming under the trade name of "limestone," as settled by the Engineering Standards Committee.

Marl.—Calcareous and argillaceous earth.

Mastic.—A generic term applied to anything gummy or adhesive. (It is the name of an Eastern gum).

Mastic Asphalte.—A term applied to asphalte melted and laid in an adhesive condition on a carriageway or footway, as distinguished from "compressed asphalte."

Matrix.—"That which encloses anything" (from mater—mother). Used in road making to designate the material which fills the voids, and is sometimes called the "filler." One terminology of this word gives it as follows: "A composition either to form a cushion or binding material for the aggregate." (This term is very loosely used, and requires revision.)

Mattress.—A term sometimes used to designate a thin blanket or cushion of fine bituminous material laid on the surface of a carriageway.

Mature.—To ripen or make ready by process of time. Tarmacadam is sometimes stored in order to mature.

Maul.—A heavy wooden mallet used generally for setting kerb.

Maund.—A basket.

Meaty.—A term sometimes used to designate a rich mortar, concrete, or bituminous mixture.

Medium.—"Instrumentality of communication; agency of transmission." Sometimes rather loosely used in road nomenclature to designate a material used in conjunction with other materials.

Mere.—A pool or lake.

Mesh.—The open space between the threads of a sieve or screen.

Metal.—A term used to designate the broken stone of which a carriageway is constructed.

Metalling.—Sometimes used instead of "metal," or generally to indicate the act of putting the broken stone on the road.

Metre.—A French measure equal to 3.281 lineal feet.

Mews.—A lane or alley in which stables are situated.

Mexphalte.—The trade name of a bituminous mixture.

Microgranite.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Milligramme.—A French measure of weight equal to .0154 of a grain.

Millimetre.—A French measure of length equal to .03937 of an inch.

Mixer.—A machine for coating stone with tar, etc.

Molten Asphalte.—A thin term for "mastic asphalte."

Momentum.—Mass multiplied by velocity in units of distance.

Monkey.—The dropping weight of a pile driver, or similar appliance.

Monolithic.—Formed of a single mass of stone.

Morass.—A swamp or marsh.

Mortar.—A mixture of lime and sand with water.

Mosaic.—A kind of inlaid work made with small sections of stones.

Mould.—Fine, soft earth.

Mudstone.—Coming under the trade name of "schist," as settled by the Engineering Standards Committee.

Mush.—A term applied to describe the mud on a tar-treated road (probably derived from the word "emulsion.")

Mushroomed.—A term sometimes used to describe a wood pavement that has become raised owing to insufficient allowance for lateral expansion.

Mylonite.—Coming under the trade name of "Hornfels," as settled by the Engineering Standards Committee.

Naphthalene.—A hydrocarbon formed during the distillation of coal gas.

Near Side.—The left side.

Nonskid-Macrete.—The trade name of a pavement.

Nonslip.—The trade name of an artificial flag or paving stone.

Norite.—Coming under the trade name of "gabbro," as settled by the Engineering Standards Committee.

Nozzle.—The orifice or outlet of a pipe or hose.

Nucleus.—The central mass about which matter is collected; the stones of a concrete compose the "nucleus."

Oblique.—"Slanting, not direct;; aslant."

Obsolescence.—The state of becoming out of date or obsolete.

Odometer.—An instrument for measuring distance.

Offset.—A perpendicular measured from a point in a line in surveying.

Ohl Process.—The trade name of a system of road construction.

Oil.—A viscous liquid insoluble in water. There are animal, vegetable and mineral oils, also fixed, volatile and essential oils.

Oil Tar, or Water-gas Tar, is derived from carburetted water-gas plant. It contains a large proportion of water which is difficult to separate.

Oleaginous.—Having the qualities of oil.

Orderly Bin.—A receptacle at the side of a road for the road-scavenging materials (vide "Bin").

Outlet.—A means of egress, a place of exit, a vent.

Output.—The quantity of material, etc., put out or produced in a specified time.

Packing.—A term used to designate the foundation of a carriageway constructed of stones which are hand-packed or pitched.

Paddles.—The arms in a mixing machine which stir and mix the materials.

Palliative.—"That which mitigates, alleviates or abates." The term is applied to certain dust-layers which only last a short time.

Parapet.—The side wall of a bridge or embankment; sometimes applied to the footwalk; especially in the North of England.

Parbuckle.—A method of levering objects into trenches with a rope.

Patch.—"To mend hastily." The term is applied as a verb to denote the repairing of a carriageway by small instalments, as opposed to "resurfacing." As a noun it is applied to small worn portions of a carriageway.

Path.—A track trodden by feet (Gr. patos, a trodden way); hence the word footpath, footway, pathway, pavement, etc.

(To be continued)

Erratum

Chain.—In the definition of this word on p. 58 of the Contract Record of November 12, the last word ("units") should read "links."

Personal Mention

Mr. R. P. Durham, vice-president of the John S. Metcalf Company, Limited, Montreal, is on a business trip to Europe.

Mr. G. F. Porter, engineer of construction of the St. Lawrence Bridge Company, Montreal, has been elected a member of the American Society of Civil Engineers.

Mr. F. A. Creighton, formerly city engineer of Prince Albert, Sask., has opened an office in the Carlton Building, Winnipeg, and will engage in consulting practice.

Prof. C. M. Carson, formerly chief of the Department of Chemistry at the university of New Brunswick, has been made head of the Department of Chemistry at the Michigan College of Mines.

Mr. S. H. Reynolds, of Victoria, B.C., formerly Assistant City Engineer of Winnipeg, has been appointed a Commissioner of the Administration Board of the Greater Winnipeg Water District.

Mr. Walter V. Appleton, formerly assistant to the superintendent of motive power, Intercolonial Railway of Canada, has been promoted to be General Master Mechanic of the headquarters at Moncton, N.B.

Mr. W. G. Chace, M.Can.Soc.C.E., of the firm of Kerry & Chace, Limited, consulting engineers, Toronto and Winnipeg, has been appointed Chief Engineer for the construction of the Greater Winnipeg Water Supply System.

Mr. John G. Sullivan, Chief Engineer of the Western Lines of the Canadian Pacific Railway, Winnipeg, was elected second vice-president of the Cornell Society of Civil Engineers at their annual meeting in New York recently.

Mr. R. O. Wynne-Roberts, M.Inst.C.E., Consulting Engineer, Regina, was in Toronto last week. After visiting London, Ont., and other points he returned west at the week-end, travelling via Chicago, and was due in Regina on Sunday night.

Mr. W. A. McLean, chief engineer of highways and a commissioner of the Ontario public roads, has been scheduled to take part in the proceedings of the tenth annual convention of the American Road Builders' Association, which opens at Philadelphia on December 9th.

Mr. J. W. Weller, chief engineer in charge of the new Welland Ship Canal construction, visited Ottawa last week in connection with tenders received by the Department of Railways and Canals for Section 5 of the canal, extending from Allenbridge to Port Robinson. The contract will be let shortly.

Obituary

Mr. Arthur J. Frith, principal of engineering at the Armour Institute, died on November 10th at Chicago.

Mr. George C. Watson, a well-known Toronto builder, passed away suddenly last week in his 76th year. The late Mr. Watson was a resident of Toronto for a quarter of a century and enjoyed the popularity of many friends in the building trade.

Mr. Lindsay, Secretary of the Vancouver Builders' Exchange, in a speech before a gathering of builders and members of allied trades said that Vancouver was the last of the large cities to organize a builders' exchange along modern lines. The by-laws of the organization have been based upon those of the Montreal, Winnipeg and other exchanges. Mayor Baxter, who followed, expressed the hope that next year it will be possible to accomplish four million dollars' worth of improvements. On the subject of additional loans he said that nothing would do more to increase the financial standing of the city than the quiet completion of what was already in hand without any more borrowing. The Mayor believed that the recent financial stringency had been a benefit rather than an injury to the city. He favored larger investments in industrial enterprises of which the prospects in Vancouver were better than ever.

Mainly Constructional

The News in Brief—From Coast to Coast

The American Institute of Architects will hold its forty-seventh annual convention at New Orleans on December 2-4.

The Toronto city council will be asked to submit a by-law on January 1st, for the contemplated erection of a $200,000 hospital in Toronto east.

Mr. Justice Lebeuf, in the Circuit Court, Montreal, has decided that a contractor is not obliged to heat a building in course of construction.

According to a report by the Controllers, the city of Montreal has spent $2,344,324 upon sidewalks and new streets during the past three years.

The Hon. R. Rogers, Minister of Public Works, announces that the largest dry dock in the British Empire will be built on Halifax Harbor, probably on the Dartmouth side.

St. Matthias Anglican Church, which was recently opened at Winnipeg, will accommodate about 1,400 people. The design is modified Gothic, the building being of brick with cut stone trimming.

Middlesex County Council have in contemplation the carrying out of extensive improvements to roads and bridges at London, Ont., at an outlay of $700,000 and a by-law will be submitted to the ratepayers soon.

The town of Sudbury, Ont., has decided to extend its power-house, pumping station at a cost of $8,606 and the necessary by-law authorizing the borrowing of the money has been passed by the municipal council.

Good progress is being made by Canadian Explosives, Limited, in the construction of their new powder works on James Island, Vancouver. The new plant, when completed, will be one of the largest and most modern in Canada.

A new organization to be known as The Marshall-Izlar Supply Company has been started in the city of Calgary. The concern will be devoted to supplying the requirements of building, railway construction and mine development.

It is stated that the city of Hull will oppose any attempt on the part of Ottawa to get the bill for the Gatineau lakes water supply through the Quebec legislature unless several clauses in the measure are either amended or withdrawn.

Montreal's city council has been asked by the Toronto Civic Guild to unite with other cities in requesting the Hon. Robert Rogers, Minister of Public Works, to throw open for competitive plans the designing of the new public buildings at Ottawa.

A new post office is to be erected at Westmount, Montreal. The style of architecture is classic with the columns, dome, pediments, etc., of cut stone. The foundation has been put in and work begun on the superstructure. Mr. Alphonse Piche is the architect.

Messrs. Armstrong, Whitworth, of Canada, Limited, the Canadian branch of the English shipbuilding and armour plate firm, which is constructing a plant in Montreal, was incorporated at Ottawa last week with two million dollars capital. The company, it is stated, will carry on the manufacture of iron, brass and steel machinery and shipbuilding. Sir Percy Girouard, K.C.M.G., Messrs. Sexton William Armstrong Noble, of London, Eng., George Green Foster and John Augustine Mann, and Mr. M. J. Butler, of Montreal, are named as the incorporators.

The architectural firm of Stevens & Lee, hospital specialists, Toronto and Boston, are to prepare a general plan for the Hamilton city hospital to be erected on the mountain top. The design of the building is to embody the latest in hospital construction and provision will be made for additional units in later years.

During the sitting of the Quebec legislature recently, the interesting statement was made that in five years there will have been constructed under the new Roads Act two thousand miles of macdamized roads in the province. Of the $10,000,000 provided by the act of 1912 the municipalities have applied for over $8,000,000.

The seventh Annual Convention of the American Society of Agricultural Engineers will be opened in Chicago on December 29th. Amongst the papers to be presented will be those dealing with the subjects of "Farm Sanitation with special reference to Water Supply," and "Concrete Drainage and Irrigation."

The Dominion Bridge Company, which is known to have had a very heavy year's business, last week closed a contract for the steel work for the new 23-storey Royal Bank Building which is now under way at the corner of King and Yonge Streets, Toronto. The contract is said to be the largest of its kind ever awarded in Canada.

The stringency in the money market is reflected by the action of the directors of the Unity Building Company, of Montreal, who have decided to defer payment of bond interest which is said to have fallen due some days ago. The capital of the company is said to be $600,000, of which $300,000 is stock and $300,000 six per cent. bonds.

The Montreal council have decided to seek powers from the Provincial Legislature to abolish the local improvement tax by which the cost of street paving is paid by fronting proprietors. Some two years ago the law was changed, and it has been agreed that the cost of paving streets since 1911 shall be charged to loan account.

The inauguration of a parcel post system in Canada is likely to lead to large structural addition being made to post office buildings in many parts of the country. This is one difficulty which the post office department is meeting with in preparing for the new system, as, in many cases, extra buildings will have to be rented until permanent ones are erected.

Building permits issued in Quebec during the month of October last reached the sum of $253,235, which, compared with the figures for the corresponding month of last year, show an increase of $171,885. From January to October of this year, the building permits have reached the sum of $1,829,080. This shows an increase over the same period last year of $920,390.

The Westmount, P.Q., Council are asking the provincial legislature for power to assess the cost of sewers, drains, streets, sidewalks, parks and playgrounds against the owners of real estate within a fixed area or specified limits. They also seek power to acquire land on Westmount Mountain by mutual agreement or expropriation for the purpose of a site for a waterworks and reservoir.

An order is stated to have been made for winding up the Superior Portland Cement Company, of Orangeville. The company was incorporated in 1892, with a nominal capital stock of $500,000, of which $400,000 is subscribed. The statement of affairs filed shows liabilities of $607,626, including $400,000 stock, $100,000 debentures and accounts payable of $26,500, bills payable, $30,650, and owing to the Bank of Hamilton, $45,000. The assets are nominally the same as the liabilities, but include $80,000 spent in organizing expenses, $80,000 for installing plant, $124,000 for the real estate, $150,000 for the plant, and some $27,000 profit and loss.

The new steel cable suspension bridge which spans the Kootenay river at Brilliant, B.C., has been practically completed. The bridge was designed by Mr. J. R. Grant and the firm of Cartwright, Matheson & Company, of Vancouver, consulting engineers, and constructed by the Doukhobor Society. The cost, including labor and all material, is given as $45,000, of which the government contributed $20,000.

The development of the leading Mormon centre of Canada is now foreshadowed by the completion of architects' plans for the $300,000 temple to be erected at Cardston, Alta., by the Mormon Church. Contracts are being closed with Cranbrook (B.C.) quarrymen for the delivery of the requisite amount of cream-colored marble. Excavation for the main structure is to be started early in the coming year.

The value of the building permits issued in Hamilton from October 31st last year to the same date this year was $5,083,050, being a decrease of $299,850 under 1912, but $909,945 over 1911. Mr. Anderson, building inspector, presenting his annual report to the board of control said it was a matter for congratulation that Hamilton could close its building year less than $300,000 behind the record set by prosperous 1912.

A by-law has been passed for the erection of a dry-dock and shipbuilding plant at Sault Ste. Marie, Ont., at a cost of $2,000,000. The work is being carried out for the Lake Superior Dry Dock and Construction Company, who also purpose erecting a dry dock, etc., on the site of the present Bellevue Park. A bonus of $20,000 a year for twenty years will be granted by the ratepayers toward the cost of the scheme.

It is reported that Sir Richard McBride, premier of British Columbia, has completed an arrangement with the Standard Oil Company to give them a charter at the coming session of the provincial legislature to build a railway through Alaska. This line will run in connection with the Chicago, Milwaukee and St. Paul Railway with headquarters in Seattle, Cincinnati, linking the Pacific Great Eastern to Fort George.

The question of the acceptance by the Montreal Controllers of the Elder Ebano Asphalt Company's contract for the supply of asphalt without advertising for other bids was before the City Council. Three aldermen complained that their requests for facilities to examine the correspondence between the controllers and different concerns with regard to the supply of asphalt to the city, previous to awarding the contract to the Elder Ebano Asphalt Company, had been ignored.

Expenditure by the Dominion public works department last year aggregated $18,844,223 according to the annual report now being issued. Of this amount $10,177,831 was spent on harbors, including dredging, and $7,420,885 on public buildings. Large buildings now under construction include a post office at St. John, costing $381,800; Quebec post office, $385,000; Montreal examining warehouse, $999,000; Brantford post office, $244,308; Toronto customs, $4,000,000; and Ottawa customs, $1,500,000.

Owing to continued complaints of the inadequacy of the service, the Montreal Tramways Company have submitted to the Council a scheme revolutionising the transportation facilities of the city. The plans include the opening up of a new artery in the down-town section, building a boulevard almost the entire length of the city, north and south, the construction of subways under railway tracks, and also underground lines, one running north and south, one east and west under St. Catherine Street, and a shorter line in the business district. The city would be expected to widen streets, guarantee bonds for the subways, and give a new franchise for forty years, those at present in force being surrendered. Two experts are to choose the exact location of the subways, and the company agree to run a freight service, principally at nights, for the convenience of contracting trades.

The Remington Arms-Union Metallic Cartridge Company of Bridgeport, Conn., has started work on its new Canadian plant at Windsor, Ont. The buildings are to be of the heavy type of brick, sawtooth construction. The roofs and gutters will be entirely of Asbestos-Steel, the new type of construction for roofs and curtain walls evolved by the Asbestos Protected Metal Company of Beaver Falls, Pa. Asbesto-Steel is a combination of concrete and rectangularly corrugated sheets of Asbestos Protected Metal.

An action by Mr. C. Dufert, architect, Montreal, to recover $175 from Mr. M. H. Schacter, Montreal, has failed. The plaintiff prepared plans for a building which the defendant contemplated erecting, but was refused payment on the ground that the plans were not acceptable, and also in virtue of an agreement that there was no obligation to pay unless they were suitable. This agreement was denied by the plaintiff, but the judge held that it was proved, the plaintiff admitting that he had frequently prepared sketches for which he received no payment.

Rapid progress is being made with the Armstrong-Whitworth plant at Longueuil, for which Mr. E. G. M. Cape is the contractor. The plant will cover an area of 35,000 square feet and contain the following departments: Raw material, crucible department, steel casting department, rolling mill, hammer mill, tempering and hardening department, twists, drills, milling cutters, taps, dies, boiler house. The building is constructed of steel and concrete and as soon as it is covered the company will commence to install equipment. The plant should be in operation about May 1st.

According to a report from Mr. Thomas Tremblay, City Engineer, the city of Sherbrooke, Que., appears to be passing through a period of considerable constructional activity. The following are amongst the larger contracts that have been given within the past few months, and which are now in course of construction:—school on Council Street, planned for the Catholic School Commissioners, at a cost of $40,000 (Mr. L. N. Audet, architect, and Mr. Alfred Dion, general contractor); school on St. Louis Street, for the same board, Mr. J. W. Gregoire being the architect and Mr. Alfred Dion the general contractor for the building which will cost $40,000; office building on Wellington Street to cost $20,000. The owner and architect of the last-named structure is Mr. J. W. Gregoire and the contractors are The Sherbrooke Construction Company.

The Cook Construction Company have made considerable progress with the enlargement of the Montreal aqueduct. The contractors are dredging the earth with drag line dredges, and these are said by the company to be more efficient than steam shovels. At the time the contract was let the proposed use of the dredges was strongly criticised, but the company expressed willingness to put up guarantees over those originally asked for. The system consists of an engine operating an arm from which is suspended by wire ropes a bucket, which is filled with material as it drags along the ground. The contents can be deposited over a very wide range, and it is claimed that the system has the advantage over steam shovels of a longer range and more economical working. Several engineers and contractors have recently inspected the system, which is to be used on the construction of the new Welland Canal.

An important point relating to the rights of property owners in connection with underground railways has been raised in the action of the Canadian Northern Montreal Tunnel Company vs Dame E. E. Archambault, wife of the Hon. H. B. Rainville, before Mr. Justice Beaudin, Montreal. The company desire to build an electric line under the property of the respondent, in Montreal, and claim that a tender of $1,000 is sufficient for such a right. The company also ask for arbitration, and desire the judge to give possession of the land on a tender of $1,500 to cover claim and costs. The respondent asks for $125,000 to be deposited, and the Court has ordered this to be done. An affidavit for the company was signed by W. F. Francis, J. S. Archibald, S. P. Brown and C. C. Mitchell, while on the other side affidavits were made by several real estate experts and P. W. St. George, V. P. Boucher, J. O. Marchand, R. A. Brassard, J. Obalaski, and others. Expert evidence is to be called from Europe and the United States.

Although the Montreal building permits for the year show a considerable increase in value on those for the corresponding period in 1912, the contracting business has not been as brisk as it was last year. Many schemes for the erection of large buildings, especially of the office class, have been held up pending better financial conditions, and it is doubtful whether some will now materialize. Ten storey office building has been a little overdone; some of those recently erected are not more than half occupied, and with two or three now nearing completion, there will be plenty of space available for some time. There is, however, a dearth of medium priced houses and flats, notwithstanding the large number erected this year; it is asserted that there is little profit in buildings of this description owing to the high price of land, labour, and material, together with the rates of interest on borrowed capital. Supply men have naturally felt the falling off in the contracting business, and at no time this year has there been the shortage in bricks and other material which handicapped contractors in 1912.

Canadian Railroad Development

The Canadian Northern Railroad is reported to be planning the immediate construction of a line from Toronto to an entrance to Buffalo.

The Dominion Government, in its endeavour to hasten the work of the Hudson Bay Railway, will probably begin construction next spring from Port Nelson, so that work can be going on from both ends. The engineer, Mr. McLachlin, is in charge of the terminal work.

At the next session of Parliament application will probably be made for an act to incorporate the Pacific, Pease River and Athabaska Railway Company, Limited. The company will seek power to construct a line at the mouth of the Maas River, B.C., ending at a point in Prince Albert, a total distance of about 1,500 miles.

The contract for the substructure of the bridge over the Fraser River at Hope has been let to Armstrong, Morrison & Company, Limited. The bridge will be one thousand feet long with three spans and two abutments. It will connect with the C. P. R. main line on the north side of the river. The contract for the upper structure has not yet been awarded.

Power is sought from the Federal Legislature by the Shefford, Bagot and Missisquoi Railway Company to construct a line through the Counties of Missisquoi, Brome, Shefford and Bagot from a point on the border line between the province of Quebec and the State of Vermont, to a point to connect with the Intercolonial Railway between Bagot and St. Eugene. It is also proposed to build two branch lines.

The completion of the great high level bridge over the Saskatchewan River, built by the Canadian Pacific Railway, has relieved that company of the expense of transferring

Barford and Perkins motor roller driving stone breaker.

freight traffic from their south side terminals over the E. Y. & P. line. Consequently tariffs to Edmonton on non-competitive traffic have been cancelled and new tariffs are being issued which will effect a saving to Edmonton consignees on such traffic from $5 to $10 a car.

Mr. J. D. McArthur, who has the contract for the Hudson Bay Railway from Le Pas to Port Nelson, was in Ottawa last week in consultation with the Department of Railways and Canals about next season's work. So far Mr. McArthur has graded over 150 of the total 400 miles, and before this season's operations close steel will be laid on 130 miles of the grade. The work of laying steel has been delayed owing to the difficulty found in obtaining and distributing the ties.

The Ungava Railway Company is to apply to parliament at its next session for incorporation, with power to construct a railway from the Hudson Bay Company post, at the mouth of the Great Whale River, or from a point below the mouth of the Great Whale River and the mouth of the Nastapoka River on the eastern coast of the Hudson Bay, whichever may be found most desirable, in an easterly or southerly direction to Aylmer Sound, on the Gulf of St. Lawrence, or to some other point on the Gulf of St. Lawrence.

The contract awarded A. J. MacDonald and Nettleton Bruce Eschback Company, Maywood, P.O., Victoria, B.C., for work for the Canadian Northern Railway, calls for fifteen miles of construction on the Patricia Branch and from Selkirk water to completed grade on main line at switch 5. The work includes 300,000 cubic yards earth excavation, 150,000 cubic yards rock excavation, 100,000 cubic yards embankment (borrow), 1,000,000 ft. B.M. timber in trestle and 18,000 lin. ft. piling. The work will not be sub-let. With completion of this contract the Canadian Northern Railway will have a main line from Victoria to Alberni, 140 miles.

Publications Received

Reinforced Concrete Construction. Vol. 2, By Geo. A. Hool, Assistant Professor of Structural Engineering in the University of Wisconsin. Drawings by Frank C. Thiessen, Instructor in Structural Engineering in the University of Wisconsin. McGraw-Hill Book Company, Inc., New York City. Price $5.00. This volume on reinforced-concrete construction treats of the design and construction of retaining walls and buildings. It has been prepared to meet the need of students having varying qualifications, and on this account is more comprehensive in some respects than the ordinary text-book dealing with these subjects. The designing work is given in detail and an effort has been made to gain clearness by the selection and arrangement of the subject matter and by numerous drawings and photographs. Part 1 is devoted to retaining walls and Part 2 to buildings. Section 1 of Part 2 deals with design and Section 2 with construction At the end of Part 2 there is a chapter containing a complete example of an estimate for a concrete building. The text throughout the various chapters is well arranged for reference and the illustrations are among the best we have seen in a work of this kind.

Water Ballast Motor Rollers

The accompanying cut illustrates the manner in which the water ballast motor rollers manufactured by Messrs. Barford & Perkins, of Peterborough, England, can be used for driving stone breakers. A large number of these rollers are in successful use and it is interesting to note that contracts have been made by the manufacturers with the authorities of a number of foreign powers, in addition to the British Government. As far as the application of these rollers to Canada is concerned the city of Winnipeg has recognized their merits by purchasing three of them. The fuel used is paraffin and the independence of coal and water is an important feature. The motor is of heavy design and especially adapted to this kind of work. The constructional features of the roller were detailed in our issue of August 20, 1913.

Readers of the Contract Record are advised to write to Canadian Billings & Spencer, Limited, Welland, Ont., for a copy of their catalogue of drop forgings manufactured from steel, brass, iron and copper. The excellence of the company's manufacture is attested by the fact that the firm's products are used by many of the leading manufacturing plants. Contractors will be particularly interested in their drop forged turnbuckles and machine wrenches, complete lines of which are always carried in stock. Quotations are submitted by the company upon receipt of models or prints.

The British Manufacturers' Association, Limited, with head offices in London, England, have opened a branch at 803 McGill Building, Montreal, under the management of Mr. R. J. McLean. The company have branches in Brazil, Argentina, and Egypt, and are agents for several prominent British firms manufacturing steam engines, steam and water turbines, machine tools, high grade steel, forgings and tool steels.

The United States Steel Products Company have succeeded in producing and offer the trade, through their representatives, B. & S. H. Thompson & Company, Limited, Montreal and Toronto, a rust-resisting sheet known as Apollo-Keystone copper bearing steel sheets. They are especially adaptable for all weather-exposed parts of buildings and all articles subject to corrosion.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brockville, Ont.

Boilers and pumps required by Town Council (Water & Light Dept.). Manager, E. J. Philip. Tenders now open for two 300 h.p. water tube boilers, one electric driven turbine pump.

Camrose, Alta.

Street Improvements, cost $10,000, by City Council. Mayor, F. P. Layton. Sec.-treas., O. B. Olson. Ratepayers will vote on by-law December 8th.

Crowland Twp., Ont.

Waterworks system contemplated by Twp. Council. Clerk, H. L. Pratt, R. R. No. 1. Welland. Arrangements will be made to secure estimates.

Galt, Ont.

Extension to watermain contemplated by Town Council. Clerk, Jos. McCartney. Extension to present 12 in. main on West Main St., from Opera House to Queen St., thence to Park Lane and to Blair road via Samuelson street.

London, Ont.

Pavement contemplated by City Council. Mayor, C. M. R. Graham. Clerk, S. Baker. Chairman No. 3 Com., B. W. Bennett, 368 York St. Engineer-in-charge, W. N. Ashplant, City Hall. Eight blocks cement pavement from G. T. R. tracks to Ottawa Ave.

Medicine Hat, Alta.

Extension and improvements to waterworks system planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th to raise $175,000 for the above work.

Ratepayers will vote on by-law Nov. 29th to raise $50,000 for grading and gravelling of streets and for purchasing road construction plant and machinery. Clerk, H. Baker. Engineer, A. K. Grimmer.

City Council, Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th to raise $60,000 for the construction of surface and storm sewers throughout the city.

Medonte Twp., Ont.

Road improvements, cost $2,430, contemplated by Twp. Council. Clerk, T. D. Robinson, Moonstone, Ont. By-law to be voted on.

Milton, Ont.

Septic tanks contemplated by County of Halton. Clerk, Wm. Panton.

Niagara Falls, Ont.

Paving planned by City Council. Mayor, C. C. Cole. Clerk, W. J. Seymour. Engineer, E. J. Anderson, City Hall. Tenders received by Clerk. 1¾ miles paving.

Ottawa, Ont.

Pavement, cost $30,000, planned by City Council (Works Dept.). Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Asphalt pavement, Bronson Ave., on 6 in. concrete foundation, with 12 in. gutters. Surface drainage to be done by day labor. Surveys made.

Chlorination buildings, Lemieux Island, cost $7,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Messrs. Alexander and Campbell have refused to accept the contract. Tenders received until Nov. 20th.

Contemplated purchase of c.i. gulley grates and frames by City Council (Works Dept.) Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. $10,000 to be allowed in estimates for 1914 to provide new pattern gully grates and frames to replace the old patterns throughout the paved streets of the city. Tenders will be called.

Subway, repaving, drainage, etc., cost $15,000, planned by City Council (Works Dept.) Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Repaving Bank street with sandstone blocks, raising and relaying concrete walks, drainage for embankments, new gullies, etc. Work to start next year. Plans drawn.

Point Grey, B.C.

Cement sidewalks planned by Municipal Council. Clerk, G. G. Heighway, Kerrisdale. Sidewalks and curbs on Second Ave., Trimble and in Eburne on 6th St. and Saskatchewan Ave. By-law passed.

Preston, Ont.

Permanent roadway contemplated by Town Council. Mayor, Otto Hemuth. Clerk, H. C. Edgar.

Alterations and extension to waterworks system contemplated by Town Council. Clerk, H. C. Edgar. By-law to be submitted to ratepayers Dec. 15th to raise $53,000 for above work.

Sudbury, Ont.

Completion of trunk sewerage system planned by Town Council. Clerk, George Elliott. Ratepayers will vote on by-law Dec. 1st, to raise $14,950 for completion of trunk sewerage system.

Toronto, Ont.

Sewers planned by Board of Control. Mayor, H. C. Hocken. Tenders close Dec. 2nd. Plans at Works Dept. Sewers on Woodbine, Annette, Clendennan, Glendonwynne, Edgewood, Eastern, Elmwood, Dundas, Chandos, Lauder, Glenholms, Blackburn and Quebec. Midway District Sewerage Scheme outlet (Danforth, Ashdale, Gillard and Felstead).

Pavements planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 2nd. Asphalt on Brown, Curson, Hartford, Homewood, Janet, Melgund, Rose. Concrete on Miles Place. Curbing on Melgund Rd. Grading on Eglinton and Boston Aves. Plans at Works Department.

Sidewalks planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 2nd. Concrete walks on Alberta, Bracondale, Gertrude, Ossington, Pendrith and Spadina Rd. Plans at Works Department.

Gradings recommended by Board of Control. Commr. of Works, R. C. Harris. Eighth, Second, Ladykirk, Indian Grove and two lanes, estimated cost $21,693.

Sewerage and water system, Mimico, contemplated by Town Council. Clerk, Andrew Dods. Consulting Engineer, T. Aird Murray, Lumsden Bldg., Toronto. By-law may be submitted to spend $70,000 now. Cost of complete system estimated at $340,000.

The Board of Control will shortly call tenders for Moore Park Drainage System (Eastern Dist.), estimated cost $88,300. Moore, Heath, Rose Park, St. Clair, Rosehill, Welland, Ethel, Hudson, Harper, Spring and McClinton. Commr. of Works, R. C. Harris.

The Board of Control will shortly call tenders for Moore Park Drainage System (Western Dist.), estimated cost $465,000. Moore, Heath, Rose Park, St. Clair, Rosehill, Welland, Grace, Wilhelm, Lexie, Kinsman, Clifton, Pleasant, McLennan, Garfield, Rosedale Heights, Sighthill, Fern and Ridge. Commr. of Works, R. C. Harris.

CONTRACTS AWARDED

Meaford, Ont.

Revetment wall, cost $30,099, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Alex. Green & John Woolich, Owen Sound.

Ottawa, Ont.

Chlorination buildings, cost $7,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractors, Alexander & Campbell, 587 Lisgar.

Point Grey, B.C.

Sewer, cost $90,000, planned by Municipal Council. Clerk, G. G. Heighway, Kerrisdale. General contractors, R. McLean & Co., 744 Hastings W., Vancouver. Contract for major portion of Augus St. sewer, including outfall.

Stamford Twp., Ont.

Waterworks system, cost $30,000, planned by Twp. Council. Clerk, Carleton Munroe, Southend. Engineer, C. Gardner, Niagara Falls, Ont. General contractor, John Lang, Port Colborne, for 6 in. pipe, at $2.25 per ft., and 8 in. pipe, at $3.00 per ft. Tenders received by Engineer until Dec. 1st for ¾ in, 1 in. 4 in., 6 in., 8 in. and 10 in. pipe, cast iron and rolled steel. Pumping plant, electric motors, automatic devices for capacity of 500,000 gals. per day, also sand pipe.

Swift Current, Sask.

Sewer and water mains planned by Town Council. Engineer, G. D. Mackie. General contractors, Moose Jaw Constr. Co.

Railroads, Bridges and Wharves

Province of B. C.
G. T. R. has been authorized to construct bridge across Nechaco River, at mileage 371.4, Prince Rupert Easterly.

Burlington Channel, Ont.
Renewal of south pier planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until 4 p.m. Dec. 15th. Plans, etc., at offices of J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, Post Office, Hamilton, Postmaster, Burlington, and at Dept., Ottawa. 270 ft. concrete superstructure.

Calgary, Alta.
Work started on temporary station and freight shed by C. N. R. General contractors and carpenters, Carter, Halls, Aldinger Co., 7th Ave. and 1st St. W. Frame construction, electric lighting, stove heating.

Edmonton, Alta.
Bridge, cost $60,000, Saskatchewan River, planned by City Council and C. P. R. Clerk, C. Cox. City Engineer, A. Latornell. General contractors, Carter, Halls, Aldinger & Co., Union Bank Bldg. Work about completed.

Bridge across Saskatchewan Ave. contemplated by Prov. Govt. and City of Edmonton. Deputy Minister, Jno. Stocks, Public Works Dept. Mayor, Mr. Short, Civic Offices. Clerk, C. Cox, Civic Offices. Negotiations are under way for the building of the bridge, thereby providing a direct approach to the Parliament Building.

Hamilton, Ont.
The G. T. R. has been authorized to construct siding into premises of Dominion Tar & Ammonia Co., Ltd.

Sidewalks, bridge, etc., contemplated by McKittrick Syndicate. Survey of 700 acres to be annexed. Syndicate will build bridge costing about $100,000 and will bear cost of local improvements.

Hope, B.C.
Bridge over Fraser River for Kettle Valley Railway Co. President, J. W. Warren. Sub-contractors, Armstrong, Morrison & Co., Ltd., 543 Granville St., Vancouver. Contract for superstructure to be let later. 1,000 ft. long, 3 spans, 2 abutments.

Kalso, B.C.
Wharf and pile boat for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. No action to be taken on this matter.

Leamington, Ont.
Cement work for John A. Campbell. Owner contemplates erecting cement breakwater along the lake shore, putting cement floor in a big onion barn and other work.

London, Ont.
Improvements to roads and bridges, cost $700,000, contemplated by Middlesex County Council. Clerk, Edmund Weld. By-law to be submitted.

Megantic, Que.
Dam planned by Town Council. Clerk, Jos. Ray. Engineer in charge, Ed. A. Evans, 92 St. Peter St., Que. Tenders received by Clerk until Jan. 5th, 1914. Concrete construction.

Montreal, Que.
Steel sheds required by Harbor Commissioners. Secretary, David Sneath, 57 Common St. Tenders received by Secretary until 12 o'clock noon, December 10th, for the construction of two steel wharf transit sheds, sections 24 and 25, Harbor of Montreal. Plans, etc., at office of F. W. Cowie, Chief Engineer.

Nelles Corners, Ont.
The G. T. R. has been authorized to construct siding into premises of Grand Gypsum Ltd.

Ottawa, Ont.
Steel wire rope required by Dom. Govt. Dept. of Naval Service. Deputy Minister, C. J. Desbarats. Tenders close Dec. 1st for rope to be delivered at Dockyards at Halifax, N.S., and Esquimalt, B.C. Plans at Dept. and Dockyards.

Copper and brass bars, etc., required by Dom. Govt. Dept. of Naval Service. Deputy Minister, C. J. Desbarats. Tenders close Dec. 15th for copper and brass bars, sheets and tubes, to be delivered at Dockyards at Halifax, N.S., and Esquimalt, B.C. Plans at Dept. and Dockyards.

Tenders close Dec. 3rd for steel and iron bars, plate and angles, to be delivered at Dockyards at Halifax, N.S., and Esquimalt, B.C. Plans at Dept. and Dockyards. Dom. Govt. Dept. of Naval Service. Deputy Minister, C. J. Desbarats.

Toronto, Ont.
C. P. R. has been authorized to construct bridge No. 92.7 on Toronto subdivision, near Donlands.

Woodward's Cove, N.B.
Breakwater planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until Dec. 16th. Plans, etc., at offices of F. G. Goodspeed, Dist. Engineer, St. John, Geoffrey Stead, Dist. Engineer, Chatham, N.B., Postmaster, Woodward's Cove and at Dept., Ottawa.

CONTRACTS AWARDED

Toronto, Ont.
Steel conduit, cost $540,000, Island, planned by Board of Control. Mayor, H. C. Hocken. General contractors, Roger Miller & Sons, Lumsden Bldg. 84 in. steel conduit on Island.

Vails Point, Ont.
Wharf, cost $6,983, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, W. A. Grier and A. J. Creighton, Owen Sound.

Public Buildings, Churches, Schools, etc.

Prov. of Alberta
Claremont School Dist. No. 3018. Treas., Alex. Blue, Saskalata. The Board of Trustees will borrow the sum of $1,500 to purchase and fence a school site, build and equip school house and erect outbuildings.

Brandon, Man.
Five cottages, cost $20,000, for Prov. Govt. Dept. of Public Works. Architect, U. V. Horwood, Winnipeg. General contractors, Willows Constr. Co., Brandon. Roofed.

Brantford, Ont.
Public school, cost $50,000, Rawdon St., planned by Board of Education. Sec., of Board, A. K. Bunnell. Chairman Building Committee, M. E. B. Cutcliffe, 93 Dufferin Ave. Architects, Taylor & Bodley, Hope Chambers. Tenders received by Secretary until November 28th.

Calgary, Alta.
Hospital, cost $30,000, planned by City Council. City Clerk, J. M. Miller. Architects, Lang & Major, Board of Trade Building.

New church, cost $35,000, Ogden, for Church Trustees. Architects and general contractors, Alberta House Builders, Grain Exchange Bldg. 30 x 60, electric light, hot air heating, fir floors, wood fibre plastering.

Dundas, Ont.
Public school contemplated by Board of Education. Chairman, C. E. Dickson. Architect not yet appointed. Site will be purchased. Brick construction.

Edmonton, Alta.
Church, cost $70,000, for Robertson Presbyterian Church Congregation. Pastor, Rev. D. G. McQueen, 408 4th. General contractor, R. Grant, 1626 Jasper Ave. Plumbing and heating, McKnight & Frost, 9th St. One storey, 96 x 135, electric lighting, steam heating, maple floors, wood fibre plastering, stained glass. Plastering.

Arts building for University of Alberta. President, Dr. Tory. Architect, Mr. Burgess. Work done by day labor. Foundations in. To be continued in spring.

Dormitory for University of Alberta. President, Dr. Tory. Architect, Mr. Burgess. Work done by day labor. 4-storeys, 83 x 206, brick and stone construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating, maple floors, wood fibre plastering, fire extinguishers. Heating and plumbing may be let. Foundations started. To be completed by Sept. 1st, 1914.

Fort William, Ont.
Addition to orphanage, cost $25,000, for Roman Catholic Denomination. Architect, H. R. Halton. General contractor, C. Mathieu. Plastering.

Guelph, Ont.
Re-building labor hall contemplated by Lot Singular, Western Hotel.

Halifax, N.S.
New church for St. Matthias Anglican Church Congregation. Rector, Rev. T. H. Perry, 2 Quinpool Rd. Architects. Harris & Horton, Keith Bldg., 41½ Barrington St. Brick construction, slate roofing. Tenders will be called shortly.

Hamilton, Ont.
New church contemplated by Ryerson Methodist Congregation. Pastor, Rev. J. B. King. To be erected in front of present Sunday School building.

Hamilton West, Ont.
Hall for Wm. Buckley. General contractors, Knight & Dickson. Two stys., frame construction, electric lighting, plumbing.

London, Ont.
Contemplated purchase of garbage equipment by City Council. Mayor, C. M. R. Graham. Supt. Garbage Collection, W. C. Dodd.

Labor Temple, $6,000, for The Arbeiter Ring. President, Jacob Wolfe, 258 Dundas St. Architects, McBride & Gilbert, Edge Block. Two storeys, white brick construction, stone and concrete foundation, electric lighting, maple floors, plumbing, lime and sand plastering. Plans in progress.

Medicine Hat, Alta.

Market buildings and weigh scales, $25,000, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th.

Montreal, Que.

Post office, Maisonneuve, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, C. Dufort, 192 St. Catherine W. Plans to be completed this winter. Tenders called in spring.

Fire station, cost $57,900, planned by Board of Commrs. Sec., L. N. Senecal. General contractor, C. E. Deakin, 41 Mayor. General contractor will sub-let some trades. Excavating.

Church and presbytery, $40,000, at Verdun, for St. Wilbrods' Congregation. Father MacDonald, Verdun. Architect, J. E. A. Benoit, 1200 Wellington St. General contractor, J. O. Hamelin, 246 Church Ave. Heating and plumbing, Conroy Bros., 291 Centre St. Stone and brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, birch and pine floors, lime and sand plastering. Foundations in.

Orillia, Ont.

The Board of the Orillia Collegiate Institute has decided not to let contract for heating system, instead, they have instructed architect to prepare plans for a system of mechanical ventilation and a remodelling of the radiators, estimated cost $3,000. Contract to be let in spring and work done in summer holidays. Sec., T. W. Robbins. Architect, J. H. Robinson.

Ottawa, Ont.

School, $85,000, planned by Public School Board. Architect, W. B. Garvock, Creighton St. School. Three stys., gas and electric lighting, steam heating, maple floors. Roofing.

Plans will likely be presented to Parliament for the establishment of plant for refining of silver ore.

Oxford Centre, Ont.

School, $6,000, planned by School Bd. Sec., Conrad Sipple, R. R. No. 2, Tavistock. Architect, J. S. Russell, 21 Downie St., Stratford. Tenders received by architect until Dec. 13th. Plans at Gazette office, Tavistock, or at architect's.

Port Rouge, Que.

College, cost $60,000, planned by School Commrs. of Pont Rouge. Sec., E. Hamel, M.P. Architect, J. S. Beyeron, 103 St. John St., Que. New plans in progress.

Quebec, Que.

Isolation hospital, Mastai, cost $75,000, planned by City Council (Health Dept.). Mayor, N. Drouin. Sec., Jos. Cote, City Hall. Architect, J. L. Pinsonnault, City Hall. New plans in progress.

Three cottages for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders close with Sec., 4 p.m. Dec. 1st for the construction of 3 Immigration Detention Cottages at Savard Park, Quebec, Que. Plans, etc., at office of Chas. Chapais, Dist. Engineer, Quebec, and at Dept., Ottawa. Stone foundation, brick construction, shingle roofing, cornices, birch floors, plumbing, wood lath, wood fibre, asbestic or other approved plastering, sheet and plate glass, hot air heating, electric lighting.

Regina, Sask.

New church, cost $50,000, for Methodist Church Congregation, 14th and Rae St. Architects, Clemesha & Portnall, Scarth St. Tenders will be called in early spring. Brick and artificial stone construction.

Stable, cost $23,900, planned by City Council (Dr. M. R. Bow, M.H.O.). Architect, R. W. Allen, City Engineer's Office. General contractors, Minkley & Traub. Heating, plumbing and electrical, Paulin & Swayze, 1778 Rose St. Interior fittings, Economy Foundry Co., Ltd., 619 Somerset Bldg. Walls up.

Water fountain planned by School Board. Supt., T. E. Perrett, c/o Alexandra School, Hamilton St. Water fountain for Albert School. Prices wanted.

St. Marys, Ont.

Barracks, cost $15,000, contemplated by Salvation Army. In charge, Major McGillivray, London. Two storeys, 70 ft. long, concrete block construction, concrete and stone foundation, electric lighting, maple, pine and concrete floors, plumbing, lime and sand plastering, seating capacity 250.

Prov. of Sask.

Contemplated, School. Owner, Berndt School Dist. No. 3066. Treas., W. A. Smith, Elbow. The Board of Trustees will borrow the sum of $1,500 for the purpose of erecting and equipping a school.

Contemplated, school. Owner, The Wright School Dist. No. 3044. Treas., Jno. Sweeny, Horizon. The Board of Trustees will borrow $1,000 for the purpose of erecting and furnishing a school.

Contemplated, school. Owner, Albermarle School Dist. No. 2845. Treas., Wm. T. Young, Rosetown. The Board of Trustees will borrow the sum of $1,800 for the purpose of erecting and furnishing a school house.

Contemplated, school. Owner, Hardwood School Dist. No. 3040. Treas, C. W. Wilson, Valence. The Board of Trustees will borrow the sum of $1,500 for the purpose of erecting and furnishing a school.

Contemplated, school. Owner, Progress School Dist. No. 2952. Treas., M. S. Sandberg, Buffalo Head. The Board of Trustees will borrow the sum of $1,500 for the purpose of erecting a school building and outbuilding.

Contemplated, school. Owner, Porcupine School Dist. No. 758. Treas. Michael Ribalkin, Whitebeech. The Board of Trustees will borrow $1,200 for the purpose of erecting and equipping a school building.

Stouffville, Ont.

Library contemplated by Village Council. Interested, R. P. Coulson. Site to be selected.

Sudbury, Ont.

Ratepayers will vote on by-law Dec. 1st to raise $22,737 for completion of fire hall and municipal buildings. Clerk, George Elliott.

Swift Current, Sask.

School planned by City Council. Sec.-Treas., J. T. Dodds. Architects, Reilly, Dawson, Hancock & Reilly, 512 Western Chmbrs., Regina. Foundation, Moore & McWilliams, $6,491. Tenders will be called about Nov. 30th for general contract.

Tide Lake, Alberta.

School contemplated by School Dist. No. 2937. Treas., B. J. Adams. The Board of Trustees will borrow the sum of $1,500 to fence school site. Build and furnish a school house and dig well.

Toronto, Ont.

School, George St., for Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov 28th for plumbing and hot water heating. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Parkdale, planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon, Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Kimberley, planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov. 28th, for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Enlarging school, Strathcona, planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov. 28th. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Tenders received by Sec. until noon Nov. 28th for metal and glass partition in St. Clair Ave. School. Sec. Board of Education, W. C.Wilkinson, City Hall.

Tenders received by Sec. Board of Education, W. C. Wilkinson, City Hall, until noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control Homewood School. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Enlargement of school, Western Ave., planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov. 28th. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Regal Rd., for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Tenders received up to noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, etc., cost $125,000, Brunswick Ave., for Loretta Abbey, Wellington W. Architect, N. C. Beggs, Cosgrave Bldg. Stone, Canadian Art Stone Co., 353 Pape Ave. Walls up one-storey.

School, Shirley, for Board of Education, Sec., W. C. Wilkinson, City Hall. Tenders received until noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Howard, for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Tenders received up to noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Vancouver, B.C.

Synagogue, cost $16,000, for Jewish Congregation. Rabbi, Dr. B. H. Rosengard, Hotel Dunsmuir. Architect to be chosen, and plans prepared at once.

Vermilion, Alta.

Government office, cost $25,000, contemplated by Dom. Govt. Dept. of Public Works. Sec., R C. Desrochers, Ottawa. Dom. Architect, Parliament Bldg., Ottawa. Site purchased, work to start in spring.

Victoria, B.C.

Jail, $80,000, planned by City Council. Clerk, Wellington J. Dowler. Tenders to be called on completion of plans.

White Rock, B.C.

School planned by Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractors, Croy & Wishart.

Winnipeg, Man.

Drill hall planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, Owners. General contractors, Carter, Halls & Aldinger, Union Bank Bldg. Only excavating will be done this year.

Law courts planned by Prov. Govt., Dept. of Public Works. Prov. Architect, V. W. Horwood, 261 Fort St. General contractors, National Construction Co., Donalda Bldg. Walls up.

Suburban fire stations, $60,000, contemplated by Board of Control. Secretary, M. Peterson. Ratepayers will vote on by-law Dec. 12th.

Public lavatories, cost $50,000, contemplated by Board of Control. Secretary, M. Peterson. Ratepayers will vote on by-law Dec. 12th.

CONTRACTS AWARDED

Avonlea, Sask.

School planned by Board. Sec.-treas., T. H. Clay. Architects, Storey & Van Egmond, Regina. General contractor, W. H. Richardson, Avonlea. Two stys., brick construction and foundation.

Calgary, Alta.

Three cottage schools, cost $37,200, for Calgary School Board, City Hall. Architect, H. McClelland, Supt. Bldg., City Hall. General contractor, T. R. Yearger. Heating and plumbing, Campbell & Hellier, 1008 17th Ave. W. Schools on Ogden, Bridge and Mt. Pleasant Sts.

Examining warehouse planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Stone, Shelly Quarry Co., 1790 9th Ave. W. Painting, Taylor Painting & Decorating Co., Sibley Block.

Edmonton, Alta.

Market building, cost $44,750, planned by City Council. Mayor, Mr. Short. Clerk, C. Cox, Civic Office. General contractors, Alson & Johnson, Gen. Del. Heating and plumbing, Sommerville Hardware Co., 1st St.

Grinrod, B.C.

School planned by Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractors, Donham & Gildemeister.

Montreal, Que.

Church for St. Luke's Congregation. Rev. W. R. Cruikshanks, 115 Drummond. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg. Excavating and foundation, Grosvalet & Lefebvre, c/o Architect.

Ottawa, Ont.

Geodetic survey building, cost $61,948, planned by Dom. Govt. Dept. of Public Works. Sec., R.-C. Desrochers, Ottawa. General contractor, W. H. McGillivray, 458 McLaren St.

Regina, Sask.

Grace church rectory, cost $6,755, for Anglican Church Congregation. Rector, Rev. E. C. Earp, 2360 Smith St. General contractors, Smith Bros. & Wilson, Hamilton St. 2½-storeys, brick construction and foundation, shingle roofing, electric lighting, hot air, maple floors. Contract awarded.

Revelstoke, B.C.

Masonic hall, cost $7,800. General contractor, O. W. Abrahamson. Two stys., 88 x 30, frame construction.

Toronto, Ont.

School, cost $36,000, for Separate School Board. Chairman Bldg. Com. Joseph Cadaret, 24 Duke St. Architect, C. J. Read, 404 Confed. Life Bldg. Masonry and brick, M. Manley, 1058 College St. Carpenter, M. J. Madden, 62 Wilson Ave. Plastering, A. J. Madden, 1139 Dufferin St. Painting, T. J. O'Connor, 64 St. Clarens Ave. Roofing, Douglas Bros., 124 Adelaide W. Concrete work, Queen City Concrete Co., 179 Broadview. 12 room building, brick construction, gas and electric lighting, steam heating, ventilating system, ornamental iron, seating, etc.

School, cost $17,000, for Separate School Board. Chairman Bldg. Com., Joseph Cadaret, 24 Duke St. Architect, C. J. Read, 404 Confed. Life Bldg. Masonry and brick, S. Young, 41 Hazelton Ave. Carpenter, T. J. Sullivan, 552 Ontario St. Painting, J. J. O'Hearn, 249 Queen W. Roofing, W. E. Dillon Co., George St. Plastering, Beaver & Sons, 62 Winchester St. Concrete, Queen City Concrete Co., 179 Broadview Ave. Four-room school.

Business Buildings and Industrial Plants

Assiniboia, Sask.

Store, $6,000, for Hub Clothing Co., Weyburn. Tenders received by owners. One storey and basement, 25 x 70, brick or concrete construction, cement foundation, maple floors, galvanized iron roofing, electric lighting, plate glass, store fronts and fixtures. Work may start this year.

Burlington, Ont.

Skating rink, cost $10,000, is contemplated by Burlington Hockey Rink Co. (W. J. Brush). Architect not yet chosen. Frame and steel construction.

Caledonia, Ont.

New Company (W. H. Huchinson) formed to build gypsum mill. Machinery and electrical power to be installed. Will also have G. T. R. switch. Plans in progress.

Calgary, Alta.

Hotel, cost $65,000, for Col. Jas. Walker. General contractors, Jones & Lyttle, 6th St. W. and Bow River. Excavating. Sub-tenders are being received by general contractors.

Warehouse, cost $10,000. Owners and general contractors, Gray & Campbell, Ltd., 10th Ave. W. Supt., J. J. McQuire, 1735 11th Ave. W. Architect, J. J. O'Gara, McLean Blk. Electrical, Budden, Beared & Cannon, Ltd., 525 17th Ave. W. Two storeys, 50 x 120. Walls started.

Two stores and apartments for Dr. Edmunds, 319 Bruner Block. Architects, Heibbell & Kelly, 2002 I.O.O.F. Bldg. General contractors, Jones & Lyttel, 6th St. W. Two or three storeys, 50 x 100. Provision will be made for 2 more stys. Excavating.

Stores and apartments, cost $30,000, for Mrs. Daintrey, 14th Ave. and 14th St. W. Architects, Hubbell & Kelly, 2002 I.O.O.F. Bldg. Tenders will be called in about 10 days. 45 x 91 and 25 x 75, terra cotta and brick construction, concrete foundation, composition paper roofing, electric lighting, steam heating, fir floors, wood fibre plastering, store fronts, sky lights, cornices, vacuum cleaners.

Cobourg, Ont.

Drying plant for Cobourg Drying Co. Supt., J. E. Hall. Building purchased and machinery to be installed. Work to start by April 1st, 1914.

Crofton, B.C.

Lumber mill contemplated by Empire Lumber Co., Victoria. Vice-president, C. C. Yount.

Edmonton, Alta.

Warehouse, cost $9,000. Owner, architect and general contractor, P. Manning, 35 Main St. Two storeys, 63 x 110, brick and frame construction, concrete foundation, shingle roofing, electric lighting, stove heating, fir floors, wood fibre plastering. Foundations in.

Warehouse, cost $70,000, for Nicholson & Bain, 656 3rd St. Architects and general contractors, Fyshe, McNeil & Martin, Lougheed Block, Calgary. Steel, Ryerson Steel Works, Chicago, Ill. Heating and plumbing, Heintz & Hooper. Six storeys, 50 x 150. Walls up.

Office building for Edwin Auld, 1459 Victoria Ave. Tenders will be called about Jan. 1st, 1914. Seven storeys, 25 x 150, steel construction.

Store and offices, cost $40,000, for Capt. A. Palmer, England. Architects, Magoon & MacDonald, Tegler Block. General contractors, Dunlop Construction Co., 205 Hart Block. Steel Manitoba Steel & Bridge Co., Winnipeg. Heating and plumbing, McKnight and Frost. Three storeys, 53 x 75. Walls up. To be finished about February.

Stores and apartments, cost $60,000, for G. D. Scott, 661 15th St. Architect, E. Underwood, Chisholm Block. Work being done by day labor under supervision of J. Armstrong, Leland Hotel. Interior trimming.

Offices, cost $7,500, for E. L. Ferris, 43 Jasper Ave. E. Architect and general contractor, J. R. Ferris, 43 Jasper Ave. E. Two storeys, electric lighting, hot air heating, wood fibre, plastering, store fronts. Roofing.

Bank and office building, cost $150,000, for Bank of British North America. Architect, R. W. Lines, Canada Permanent Bldg. General contractors, masonry, carpentry and roofing, Nesbitt & Miller, 315 Jasper Ave. E. Steel, Manitoba Bridge Co., Winnipeg. Heating & plumbing, Ross Bros., 39 Greesback St. Elec., Burnham Frith Elec. Co., Howard Ave. Elevator, Otis Fensom Elevator Co., Montreal. Walls started.

Hamilton, Ont.
Extension to Jockey Club Hotel, at a cost of $40,000, is contemplated in the spring.

Iroquois Falls, Ont.
Stores and residences. Owner and general contractors, Abitibi Pulp & Paper Co. Owners contemplate building a large number of stores and houses. Plans drawn. Work to start early next year. Tenders have not yet been called.

London, Ont.
Rebuilding warehouse of Ontario Spring Bed & Mattress Co., 90 York St. Manager, S. Williams. Work to be done by company's staff. Will require lumber, flooring, tin roofing, glass, machinery, etc. Work of clearing up ruins has commenced.

Storage cell, etc., planned by City Council (Fire & Light Com.). Mayor, C. M. R. Graham. Clerk, S. Baker. Fire Chief Aiken, Central Fire Hall. Tenders received for storage battery and rectifier, 6 volts, 100 amperes, to be used in connection with alarm system.

Medicine Hat, Alta.
Murdock McLeod, Moncton, N.B., contemplates erecting factory at a cost of $10,000, for manufacturing clothes, etc. Brick construction.

Montreal, Que.
Bank, cost $11,000, for Home Bank of Canada, Transportation Bldg., Montreal. Architects, Turner & Careless, Board of Trade Bldg. General contractors, Archambault & Conway, 332 Bleury. General contractors will receive tenders for roofing, plastering, painting, heating, plumbing and electrical after Nov. 18th. Three storeys, 25 x 65, concrete foundation, solid brick construction, slate roofing, gas and electric lighting, stove and hot water heating, maple and pine floors, lime and sand plaster, plate glass. Excavating.

Hotel for The Shubert Co., New York, N.Y. Architect, D. J. Spence, 46 Beaver Hall Hill.

Stores, Westmount (Victoria and Sherbrooke), for F. P. Buchanan, Victoria Ave. and Sherbrooke. Architect, H. E. Shorey, 56 Beaver Hall Hill. General contractor, A. F. Byers, 340 University. General contractor doing all trades. Foundations in.

Garage, cost $15,000, for Miss E. Beaudry, care architect, C. St. John, 244 St. Catherine Street East. Tenders for General Contractor received by Architect to close shortly. Three storeys, 65 x 25, concrete foundation, waterproofed, brick construction, felt and gravel roofing, electric lighting, hot water heating, mill floors (5 in.), lime and sand plaster, freight elevator.

Bank and offices, cost $14,000, Verdun. Owner, Bank of British North America, 30 St. James St. General contractor, C. J. Brown, 4263 St. Catherine St. Tenders received by General Contractor for plastering, painting, heating, plumbing, electrical and interior fittings.

New Glasgow, N.S.
Cold storage warehouse contemplated by, Jno. T. Nickerson, Liverpool, N.S. Work may not be started until spring.

New Westminster, B.C.
Jno. K. Mackenzie & Bruce Loopman have purchased the Colonial Hotel and will have alterations made.

North Sydney, N.S.
Store and office, cost $15,000, for McCallum & McMillan. Architect, B. A. Huntsman, Sydney. General contractor, F. C. Redding. Painting, H. Clarke. Heating and plumbing, Hartigan & Co., Sydney Mines. General Contractor will receive tenders for electrical work and interior fittings until Nov. 30th. Two storeys, 60 x 53. Foundations in.

Oakville, Ont.
Planing mill for Davis & Doty. 45 x 100, machinery and electric motors required. Work started.

Paint factory, for J. Langmuir & Co., 1372 Bathurst St., Toronto. Work, day labor. One storey, 76 x120, brick construction, felt and gravel roofing, electric lighting, steam heating, birch and concrete floors, boilers. Walls going up.

Ottawa, Ont.
Business Block, cost $100,000, for Mrs. Cowie, Albert St. Arch. C. P. Meredith, 126 Sparks St. Felt and gravel roofing, electric lighting, steam heating. Walls up.

Theatre, $40,000, for H. Brouse, Bank St. Architect, W. Herbert George, Castle Bldg., Queen St. Foundations in. Subtenders to be called shortly. Solid brick construction.

Stores and residences, cost $12,000, for Oakland Land Co., c/o W. J. Spratt, Sunnyside Ave. Mason, Docherty Bros., Willard St. Carpenters, James & Ramsay, Pansy Ave. Other contracts not let yet, Two storeys, 50 x 50. Excavating.

Church, cost $6,000, Lyon, for St. Peters Evangelical Lutheran Congregation. Pastor, Mr. Clemmens, 250 Lyon. Architect, Herbert Shleacow, Room 45, Sparks Chmbrs. Carpenters, Alexander & Campbell, 587 Lisgar. Electrical not let yet. Foundations in.

Factory, cost $6,000. Owner, architect and general contractor, Wm. F. Frazer, 279 Arlington Ave. Electrical and motors, W. R. McCallum & Co., 263 Laurier W. 50 x 60, concrete and stucco construction. Walls going up.

Office and warehouse, cost $10,000, for J. T. Blythe, 394 Bank St. General contractors, Alexander & Campbell, Lisgar St. 40 x 70, Roofed.

Coal sheds, stables, storage, etc., cost $30,000. Architects and general contractors, J. G. Butterworth & Co., 86 Sparks St. Elec., Costello & Crowe, 86½ Lyon St. Stabes, walls up. Storage, roofing.

Penticton, B.C.
Evaporator contemplated by H. B. Cossart (care Greer & Wanless) and L. B. De Gero.

Prince Albert, Sack.
Ice house, $5,000. Owner, architect & general contractor, R. Gilmore, 418 E. 14th St. One storey, 50 x 110, mill construction, concrete foundation, composition paper roofing, ventilating system, concrete floors. Capacity 4,000 tons. Plans in progress.

St. John, N.B.
Nail and wire fence factory for a syndicate, c/o Gordon Johnston, 103 Princess St.; Harry Marvin, 144 Douglas Avenue. Architect, Garnet Wilson, 50 Princess St. 1½ storeys, 125 x 50, concrete foundation, brick construction, electric lighting, birch floors, steam heating. Plans in progress.

Spuzzom, B.C.
Sawmill, etc., contemplated by J. C. Shields, 212 Winch Bldg., Vancouver. Owner has purchased timber tract containing approximately 150,000,000 B. Ft., near Spuzzom on the C. P. R. Besides a sawmill, a flume will be built from the limit to the C. P. R. and a planing mill where the flume meets the C. P. R.

Timmins, Ont.
Bank, cost $10,000, contemplated by the Imperial Bank of Canada. Architect, W. E. Binning, Cochrane. Recommendation has been made to bank. Work may be started this winter. Two storeys, 30 x 40, brick veneer construction, concrete foundation, felt and gravel roofing, electric lighting, hot water heating, birch floors, lime and sand plastering, bank fixtures, vaults.

Toronto, Ont.
Theatre. Owners and general contractors, Wilson Lumber Co., 1 Spadina Ave. Architect, A. H. Start, 105 Melville Ave. Mason work done by day labor. Carpenter, Chas. Spall, 279 Palmerston. Seating capacity, 500. Two storeys, 30 x 70. Walls going up.

Warehouse for H. Rotenburg, University and Anderson. Architect, I. Feldman, 199 Yonge St. Tenders close with Architect about Nov. 27th. Six storeys, brick construction, felt and gravel roofing, gas and electric lighting, steam heating, galvanized iron, fire escapes, elevator, boilers.

Residence, stable and dairy, cost $9,000. Owner and general contractor, W. Hodgkinson, 663 Carlaw Ave. Owner will sub-let some trades. 2½-storeys, 28 x 46, brick and steel construction, concrete and brick foundation, shingles, felt and gravel roofing, gas and electric lighting, hot water heating, oak, birch, concrete and spruce floors, lime and sand plastering, wood lath, built in fireplaces, mantels, store fixtures. Plans drawn.

Victoria, B.C.
Alterations and additions to hotel, cost $17,500, for Thos. R. Danes. Architect, H. C. Feree, 220 Sayward Bldg. General contractors, Parfit Bros., 1303 Gladstone. Mill construction. Work in progress.

Winnipeg, Man.
Stores, cost $6,000. Owner and general contractor, T. Ryan, 44 Princess St. One storey, 70 x 50, brick construction, stone, brick and concrete foundation, felt and gravel roofing, electric lighting, stove heating, maple floors. Plans drawn.

CONTRACTS AWARDED

Caledonia, Ont.
Warehouse for The Aalbastine Co., Head Office, Paris, Ont. General contractors, Schultz Bros., Brantford. Mason, James Blake, Caladonia.

Kingston, Ont.
Alterations to skating rink for Queens University. General contractor, W. J. Chapman, Queen St. Changes to be made in the seating.

Montreal, Que.
Store and flats, $5,000, at Maisonneuve, for Mrs. A. Dubois, 4th Ave. and Notre Dame E. Architect, L. R. Mont Briant, St. Andre St. General contractor, Jos. Trudel, 1st ave. Three storeys, 27 x 30 concrete foundation, frame and brick construction, felt and gravel roofing, gas

(Continued on page 71)

Tenders and For Sale Department

TENDERS

Sealed tenders will be received up to seven o'clock precise, **Saturday, November 29th, 1913,** for the construction of a steel bridge with concrete pillars across the Beaudette River in the Parish of St. Telesphore, Soulange, Co., P.Q.

Tenders must be accompanied by a certified cheque for 10 per cent. of the amount, and should be addressed to the Secretary-Treasurer of the Municipality of the Parish of St. Telesphore, Soulange Co., P.Q. The Council is not held to accept the lowest or any other tender.

Plans and specifications can be seen at the office of the Secretary-Treasurer.

Separate tenders can be prepared, one for the concrete pillars, and the other for the steel superstructure or for both.

JAS. ED. CHARLEBOIS,
Secretary-Treasurer.
St. Telesphore, Nov. 6, 1913. 46-48

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon, on **Tuesday, December 2, 1913,** for the construction of the following works:

Sewers

Midway District Sewerage Scheme Outlet, from Gillard avenue and Felstead avenue to Danforth avenue and Lamb avenue, via Felstead avenue and Lamb avenue, and on Danforth avenue from Ashdale avenue to Leslie street.

Midway District Sewerage Scheme Outlet, from Gillard avenue and Felstead avenue to Danforth avenue and Hillingdon avenue, via Felstead, Ashdale and Danforth avenues.

Woodbine avenue, from Kingston road to Danforth avenue.

Annette street, from Quebec avenue to Pacific avenue, and from Keele street to Dundas street.

Clendennan avenue, Glendonwynne road to Annette street.

Glendonwynne road, Clendennan avenue to Humberside avenue.

Edgewood avenue, from the bridge to Small St.

Eastern avenue, from Heward avenue to Pape avenue.

Elmwood avenue, from Davenport road to Ashburnham avenue.

Dundas street, 83 ft. west of Lansdowne avenue to 150 ft. 6 in. further west.

Chandos avenue, Lightbourne avenue to 437 ft. west.

Lauder avenue, from Rosemount avenue to Regal road.

Glenholme avenue, Rosemount avenue to Regal road.

Blackburn avenue, Gerrard street to Mount Stephen street.

Quebec avenue, from Clara street to Glendonwynne road.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties, approved by the City Treasurer, or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid. Conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
Toronto, November 20, 1913. 48

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuses, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
47-48 Woodstock, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Renewal of South Pier at Burlington Channel, Ont.," will be received at this office until 4 p.m. on **Monday, December 15, 1913,** for the renewal of South Pier at Burlington Channel, Wentforth County, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department, at the District Engineer's office, Confederation Life Building, Toronto, Ont.; at the Post Office at Hamilton, Ont., and on application to the Postmaster at Burlington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, November 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46299. 47-48

Tenders for Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 2nd, 1913.**

- *1. Asphalt (Refined).
- 2. Crushed Limestone (all sizes).
- 3. Cedar Posts.
- 4. Portland Cement.
- *5. Granite Setts.
- 6. Hardware (Pipe Fittings, Valves, Tools and General).
- 7. Iron Castings, Manholes, etc.
- 8. Limestone Dust.
- 9. Lumber.
- *10. Paving Blocks, Vitrified.
- 11. Lubricating Oil, Coal Oil, Gasoline.
- 12. Rubber Valves, Packing Hose, etc.
- 13. Sewer Pipe, Vitrified.
- 14. Sewer Bricks.
- 15. Sand and Gravel.
- 16. Street Tablets.
- *17. Treated Wood Blocks.

*Will be called later.

Specification and tender form for any of the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto.
November 18th, 1913. 48

Toronto Harbor

Equipment Wanted

We are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on our work in

PROPOSALS WANTED

from

Experienced Contractors

for

Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to

CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

48-49

Contractor with Steam Shovel, Cars, Track, Horses, Scrapers, etc., would like to hear from parties having railroad grading or other work to let. Address "Contractor," c/o Contract Record, Toronto. 48

WANTED

A 3 to 5 ton double drum Hoisting Engine with swinger and boiler complete.

Also a 3 to 5 ton timber stiff leg derrick.

Sun Brick Co., Limited,
1023 Traders Bank Building,
48-49 **Toronto, Ontario**

Tenders for One Overhead Hand Operated Travelling Crane

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 16th, 1913.**

One Overhead Hand-Operated Travelling Crane, having a working load of 40,000 pounds, for Main Pumping Station, foot of John Street.

Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
November 18th, 1913. 48

Business Buildings and Industrial Plants

(Continued from page 69)

and electric lighting, hot water heating, pine floors, lime and sand plaster, wood lath.

Winnipeg, Man.

Elevator repairs, at Transcona, cost $30,000, for C. P. R. General contractors, New York Foundation Co., c/o Barnett & McQueen, North Transcona.

Windsor, Ont.

Addition to bakery, cost $12,000, for Neal Baking Co., Salter Ave. Architects, Watt & Blackwell, Bank of Toronto Bldg., London. General contractors, Canadian Frost & Winchester Co., Ltd., Ouellette Ave.

Stores and apartment house, cost $40,000. Architects, Watt & Blackwell (in trust), Bank of Toronto Bldg., London. General contractor, V. Williamson, Walkerville. General Contractor will call sub tenders later.

Residences

Edmonton, Alta.

Two residences, cost $6,000. Owner, architect and general contractor, W. A. Passmore, 42 4th St. E. Two storeys, 24 x 28, frame construction, concrete foundation, shingle roofing, electric light, hot air heating, wood fibre plastering, one built in fireplace. Excavating.

Apartment house, cost $15,000, for Mrs. Z. Frontaine, 1st Ave. S. Plastering not let. Painting, heating and plumbing, Strathcona Plumbing & Heating Co. Electrical, Burnham Firth Electric Co., Howard and Rice St. Three storeys, frame construction, concrete foundation, felt and gravel roofing, electric lighting, maple floors, wood fibre plastering. Walls up three storeys.

Farnham, Que.

Semi-detached residences planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until Dec. 9th. Plans, etc., at offices of R. L. Deschamps, Overseer, Dom. Public Bldgs., Post Office, Montreal, J. Belanger, caretaker, Public Bldg., Farnham, and at Dept., Ottawa.

Montreal, Que.

Six flats, cost $6,000, at Rosemount. Owners and general contractors, Trudeau & Laframboise, 182 St. Catherine E. Architects, Audet & Charbonneau, 15 St. James St. Brick, Durocher & Amel, Rosemount. Foundations in. Other trades to be given shortly. Three stys., 37 x 54.

Nine flats, cost $7,000. Owner and general contractor, G. Vermette, 780 Berri. Work done by day labor. Three storeys, 42 x 58, concrete foundation, felt and gravel roofing. Foundations in.

30 flats, cost $20,000. Owner and general contractor, A. Campbell, 190 Selby, Westmount. Plastering, will call tenders Jan 1st. Heating and plumbing, E. Mallett, 1602 Notre Dame W. Three stys., 35 x 61, concrete foundation, felt and gravel roofing. Foundations in.

10 flats, cost $23,000. Owner and general contractor, J. H. Hand, 609 Belmont Ave. Architect, W. S. Wright, 204 St. James. Roofing, D. Nicholson, 679 St. Paul. Electrical MacDonald & Wilson, 99 Drummond. Two storeys, 120 x 71, felt and gravel roofing, hot water heating. Roofing.

Residence, cost $15,000, for W. J. Brennon, 421 Mount Pleasant. Architects, Gordon & Aird, 115 Stanley St. Plastering, MacIntyre Plastering Co., 55 Latour Electrical, W. J. O'Leary & Co., 36 Recollect. Plastering.

Residence, cost $23,000, at Westmount, for J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. Foundations in. Architect will call for some trades next week, probably plastering and roofing.

Cottages, cost $16,000, at Westmount. Owners and general contractors, White Construction Co., 306 Coronation Bldg., St. Catherine W. Concrete foundation, stone and brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, hardwood floors, lime and sand plaster, plate glass. Excavating.

Residences, cost $24,000, at Outremont. Owner and general contractor, T. Forest, 131 De L'Epee Ave. Architect, J. E. Branchaud. General contractor wishes tenders on plastering, brick, painting, heating, plumbing and electric at once. Three storeys, 84 x 78, concrete foundation, Scotch brick construction, felt and gravel roofing, electric lighting, hot water heating. Excavating.

Residence, cost $19,000, for Miss B. Papineau, 92 Notre Dame E. Architect, R. Gariepy, 25 St. James. General contractors, Heon Roy & McLeod, care architect. Two storeys, 36 x 56, stone and brick construction, gas and electric lighting, hot water heating, hardwood floors, marble tiling, plate glass, built-in fireplaces, mantels. Foundations in.

Montreal West, Que.

Semi-detached cottages, cost $10,000, for W. S. P. Burns. Architects, Benoit & Girard, 215 St. Catherine W. Project has been dropped, will probably go ahead in spring.

Ottawa, Ont.

Residence, cost $5,000, contemplated by J. W. Stanley, 146 Breezehill Ave. Brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch and pine floors, water heaters.

Residence, $6,000. Owner and general contractor, J. D. Wilson, 17 Clarey. Mason, R. Saunders, Lees Ave. Other contracts not let. 2½ storeys, brick veneer construction. Foundations started.

Residence, $10,000, for Dr. Quinn, care Architect, F. C. Sullivan, Castle Bldg., Queen St. General contractor and carpenter, T. A. Shore, 41 Chamberlain. Plastering and painting, day labor under supervision of architect. Three storeys. Walls up two storeys.

Residence, cost $6,000, for D. W. Gatourey. Architect, F. C. Sullivan, Castle Bldg., Queen St. Work being done by day labor under supervision of Architect. Electrical not let. Walls up.

Residence, cost $10,000. Owner and architect, W. E. Noffke, Central Chmbrs. General contractor, Owner, by day labor. Electrical, W. R. McCallum & Co., 263 Laurier W. Walls up.

Regina, Sask.

Residence, $5,000. Owner and general contractor, A. C. Froom, 2235 Osler St. Two storeys. Foundations in.

Residence, cost $5,000. Owner and general contractor, R. J. Nicholson, 2247 Cameron St. Brick and frame construction, shingle roofing, electric lighting, hot air heating. Foundations in.

Sudbury, Ont.

Residence, cost $6,000. Owner and general contractor, H. D. Evans, College St. 2½-storeys, 36 x 20, brick construction, shingle roofing, electric lighting, hot air heating, birch floors, plumbing, hard wall plastering, wood lath. Foundations in.

Toronto, Ont.

Apartments, cost $12,000. Owner and general contractor, M. Shienkman, 405 Runnymede Rd. Masonry and carpentry, day labor. Heating, Dom. Radiator Co., Dufferin St. Plumbing, M. Burman, 142 Evelyn. Electrical, Emas Electrical Co., 703½ Queen W. Three storeys, 40 x 60. Walls going up.

Two detached residences, cost $5,000. Owners and general contractors, Kerr & Martin, 311 Woodville. Will sub-let some trades. 2½-storeys, 20 x 38, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in fireplace. Plans drawn.

Apartments, cost $35,000. Owners, general contractors and carpenter, Donnenfield Bros., 336 Clinton St. Mason, T. H. Jones & Co., 314 Clinton St. Owners will sub-let roofing, plastering, painting, heating, plumbing and electrical Three storeys, 42 x 64, brick and steel construction, concrete foundation, waterproofed, felt and gravel roofing, gas and electric lighting, hot water heating, birch, oak and spruce floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Excavating.

Windsor, Ont.

Residence, cost $7,000, for Dr. A. E. Bowman, V.S. Architects, Leybourne & Whitney. Tenders received by architect until Nov. 29th. Hospital plans not yet started. Two storeys, 33 x 31, brick veneer construction, brick foundation, shingle roofing, electric lighting, hot water heating, oak and maple floors, water heaters, hard wall plastering, art glass, built-in fireplaces.

Winnipeg, Man.

Apartment Block, cost $65,000, for D. H. Bradley, care architect, A. B. Scarlett, 797 Jessie Ave. General contractors, Winnipeg Stone Co., Elmwood. Roofing.

CONTRACTS AWARDED

Calgary, Alta.

Residence, cost $9,000, for R. A. Darker, 805 Centre St. Architects, Holman & Gotch, Dom. Bank Bldg. General contractor, D. Cunningham, 1509 15th Ave. W. 1½-storeys, 44 x 44, brick veneer construction, hollow tile walls, concrete foundation, shingle roofing, vacuum vapour heating, fire and hardwood floors, electric lighting, wood fibre plastering, vacuum cleaner.

Montreal, Que.

Residence, cost $8,000, for J. W. Brown, 65 Summerhill Ave. General contractors, Archambault & Conway, 332 Bleury. Heating and plumbing, Wm. Budd, 1914 Esplande Ave. Electric to be given shortly.

Power Plants, Electricity and Telephones

Bowness, Alta.

Electrical machinery required by Bowness Improvement Co. Engineer-in-charge, T. L. Turnbull, 202 8th Ave. W., Calgary. One 200 kw. traction motor; one 4-panel switchboard; one 250 kv.a. generator; one gas engine. Tenders will be received until Dec. 31st.

Castor, Alta.

Gas wells and lighting extension. By-law passed by Town Council Nov. 8th, 1913, to raise $20,000 to complete the above work. Commissioner, L. B. Brown, Grand Ave.

Guelph, Ont.

Contemplated purchase of street cars by City Council (Railway Board). Clerk, T. J. Moore. Ratepayers will vote on by-law to raise $17,000 for purchase of two new cars for the Elora Road and Waterloo Ave. line.

London, Ont.

Addition to hydro sub-station planned by City Council (Water & Light Commission). Chairman, Philip Pocock. General manager, Comsn., H. J. Glaubitz. Tenders will not be called until spring.

Medicine Hat, Alta.

Extension to power and electric lighting contemplated by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th to raise $150,000 for the above work.

Niagara Falls, Ont.

Power plant and raceway contemplated by a Syndicate. Engineer, Fred Walker, 39 Broadway, New York City. Surveys being made.

Ottawa, Ont.

Standards and lamps required by City Council (Elec. Dept.) Engineer, Supt. J. Brown. "White Way System" from Gladstone ave. to Bank St. Bridge, distance 6,400 lin. ft. or 1.21 miles. Total length of lights will be 2.42 or almost 2½ miles.

Preston, Ont.

Alterations and extension to electric lighting system contemplated by Town Council. Clerk, H. C. Edgar. By-law to be submitted to ratepayers Dec. 15th to raise $18,000 for above work.

Regina, Sask.

Pumps required by School Board. Architect, J. H. Puntin, Room 308 Darke Block. Tenders received by architect for automatic air pressure electric force pumps, to regulate water pressure for Connaught, Benson and Wetmore schools.

Sudbury, Ont.

Extension to power house and pumping station, $8,000, contemplated by Town Council. Clerk, George Elliott. Ratepayers will vote on by-law Dec. 1st.

Extension to electric lighting system, $9,844.48, contemplated by Town Council. Clerk, George Elliott. By-law will be submitted to ratepayers Dec. 1st.

Toronto, Ont.

Board of Control, Commissioner of Works R. C. Harris, recommend new civic lines on Greenwood, Glen Rd. and Mt. Pleasant Rd., Christie, Lansdowne and Lake Shore Road. Estimated cost $1,000,000.

Winnipeg, Man.

Power house, $5,000, planned by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Claydon Bros., Furby Place. 40 x 40, brick construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating. Excavating.

Power house, $158,000, planned by Provincial Govt., Dept. of Public Works. Provincial Architect, V. W. Horwood, 261 Fort St. General contractors, National Construction Co., Donalda Bldg. Foundations going in.

Fire apparatus required by Board of Control. Secretary, M. Peterson. Chief, J. E. Buchanan, Fire Dept. Two 60 h.p. motor hose wagons with steel bodies. One 80 h.p. motor aerial ladder truck, 75 ft. Tenders received by Board until December 15th. Specifications, etc., at office of Engineer.

Fire apparatus required by Board of Control. Secretary, M. Peterson. Chief, J. E. Buchanan, Fire Dept. Two horse-drawn, hook and ladder trucks. One 20 h.p. automobile runabout; 30 fire alarm boxes, 5,000 ft. -2½-in. cotton, rubber lined fire hose. Tenders received by Board until November 28th.

500 kw. motor generator set for generating station at Point du Bois required by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. Tenders received by Board until Nov. 19th. Specifications, etc., at office of engineer.

Vacuum cleaner required by Board of Control. Secretary, M. Peterson. Tenders received by Chairman, Board of Control until 11 a.m., Nov. 26th, for the supply and installation of a vacuum cleaning machine for the King George Isolation Hospital. Specifications, etc., at office of the Secretary of Municipal Hospital Commission, Morley Ave.

Welland, Ont.

Extension to hydro electric system, cost $20,000, planned by Town Council. Clerk, C. M. Webber. Secretary Hydro Commission, H. E. Timmerman. By-law passed and equipment required.

CONTRACTS AWARDED

Calgary, Alta.

Transformers required by City Council. Clerk, J. M. Miller. Electrician, R. A. Brown. Contract awarded to General Supplies Ltd., 1233 2nd St. E. Canadian Maloney Co. and Canadian General Electric Co., Ltd., 325a 8th Ave. W.

Guelph, Ont.

Plumbing, heating, etc., planned by Prov. Govt., Dept. Public Works. Sec., H. E. McNaughten, Parliament Bldgs., Toronto. General contractors. Stevenson & Malcolm Co., Guelph, for plumbing, heating, wiring and ventilating in dining hall at Ontario Agricultural College.

Plumbing, heating, etc., required by Prov. Govt., Dept. Public Works. Sec., H. F. McNaughten, Parliament Bldgs., Toronto. General contractors. Stevenson & Malcolm Co., Guelph, for plumbing, heating, wiring and ventilating in Poultry Bldg. at Ontario Agricultural College.

Plumbing, heating and wiring for Provincial Govt., Dept. Public Works. Sec., H. F. McNaughten, Parliament Bldgs., Toronto. General contractors. Stevenson & Malcolm Co., Guelph, for plumbing, etc., in Husbandry Bldg., at Ontario Agricultural College.

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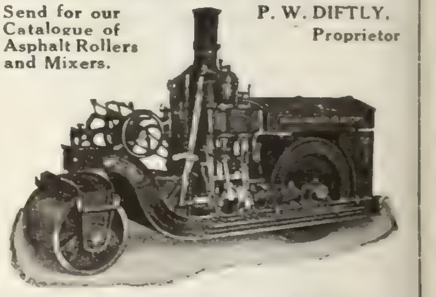

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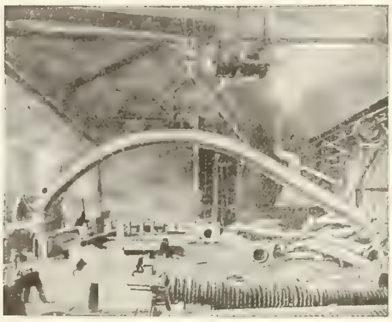

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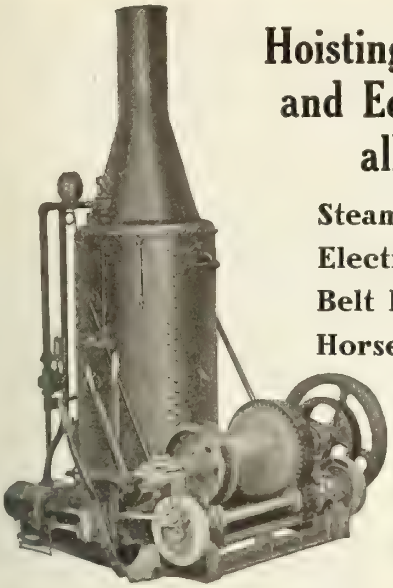

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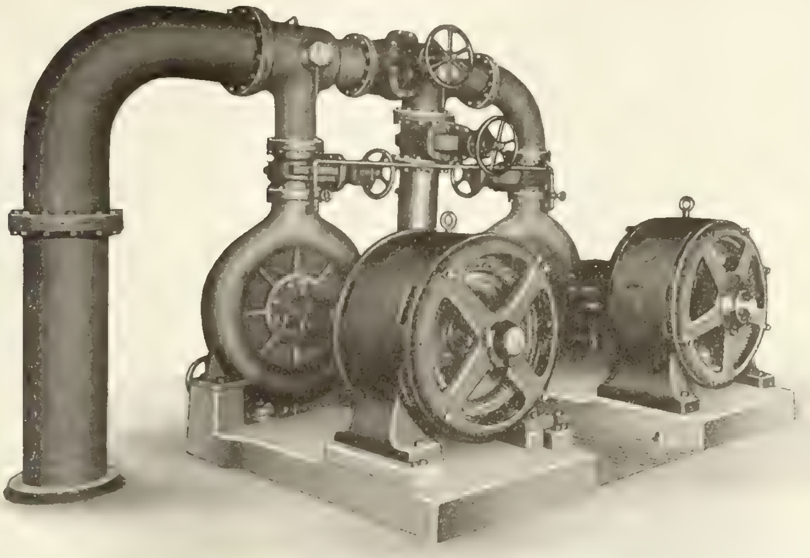

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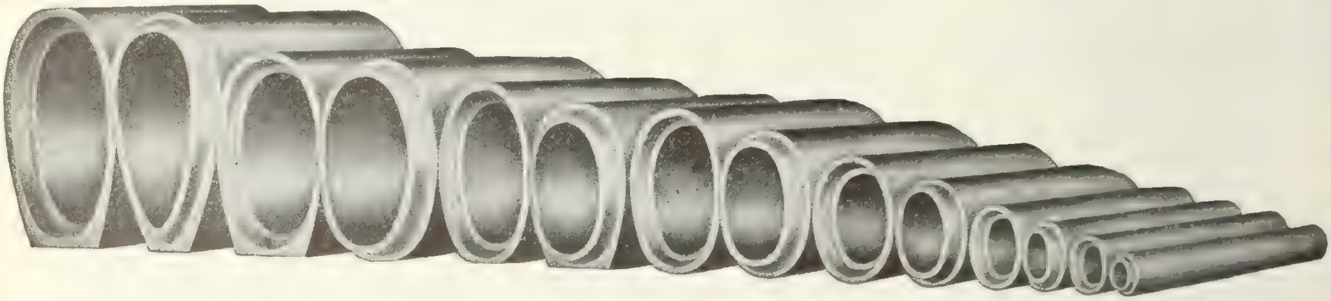

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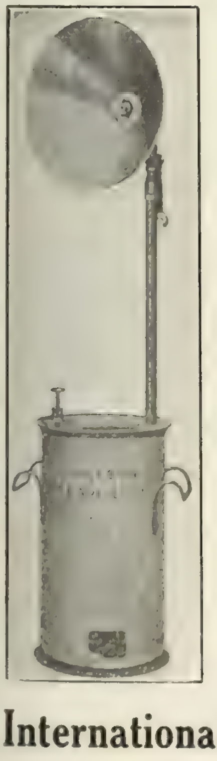

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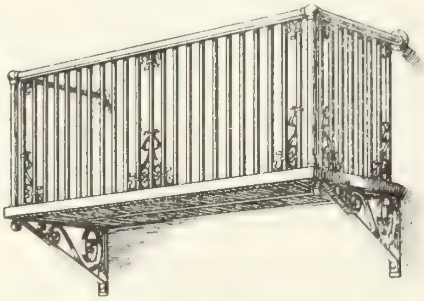

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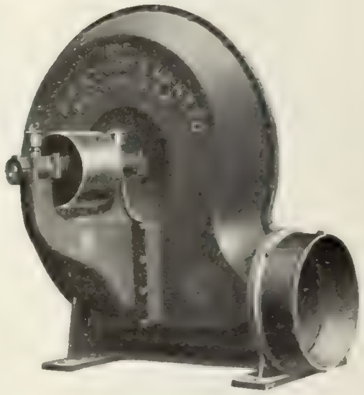

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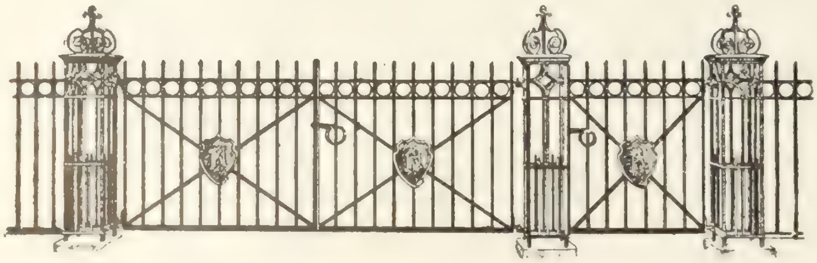

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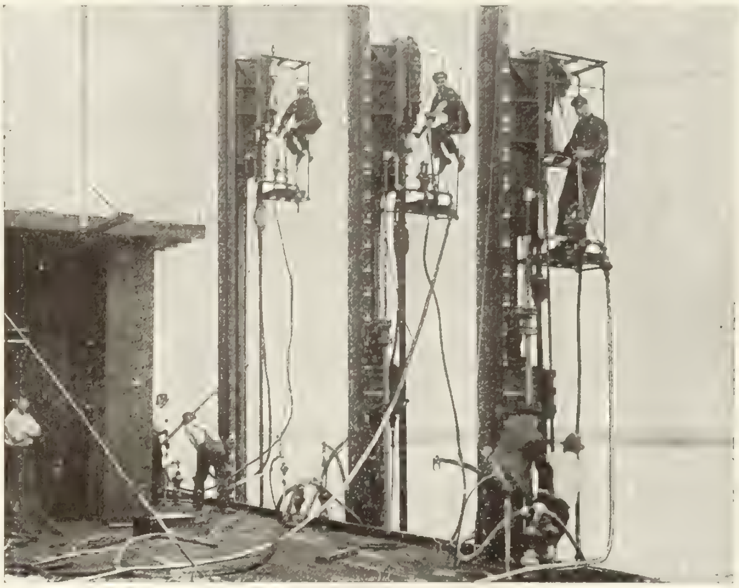

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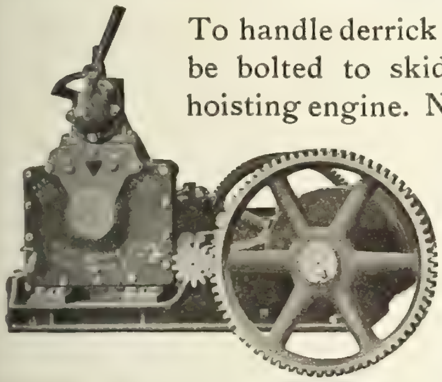

To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

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Grand Haven, Mich.

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"Queenston Blue" Limestone

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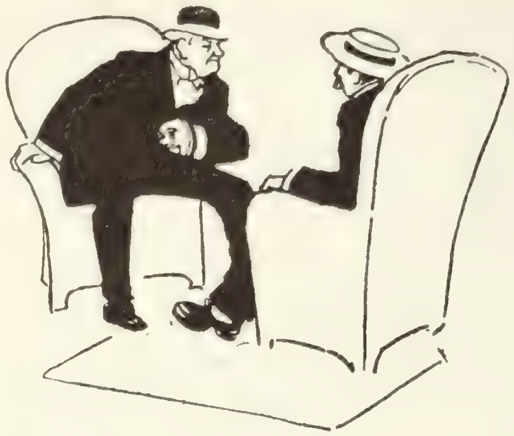

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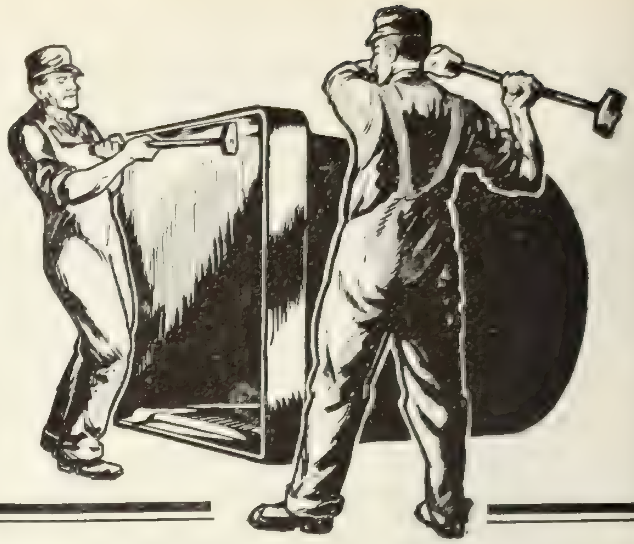

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We can supply you with one that will suit your requirements.

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Are built in a seperate Department of our enlarged Boiler Shop which is devoted entirely to this work. Special care is taken to see that every job that goes through is turned out right.

Besides building a full line of Settling and Washing Tanks, Pressure Tanks and Storage Bins, we manufacture all sizes and kinds of:—

Steel Cookers, Steel Conveyors, Steel Elevators, Steel Buckets, Rivetted Steel Pipe, Steel Troughing, Smoke Breechings, Steel Stacks and Refuse Burners.

If you have a difficult job under any of these heads send your sketches to us. Our prices are reasonable. We guarantee our workmanship.

The Waterous Engine Works Company, Limited
BRANTFORD - CANADA

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

		Star	D.D.
10 to 25	united inches	$4 25	$ 6 25
26 to 40	"	4 60	6 75
41 to 50	"	5 10	7 50
51 to 60	"	5 35	8 50
61 to 70	"	5 75	9 75
71 to 80	"	6 25	11 00
81 to 85	"	7 00	12 50
86 to 90	"		15 00
91 to 95	"		17 50
96 to 100	"		20 50
101 to 105	"		24 00
106 to 110	"		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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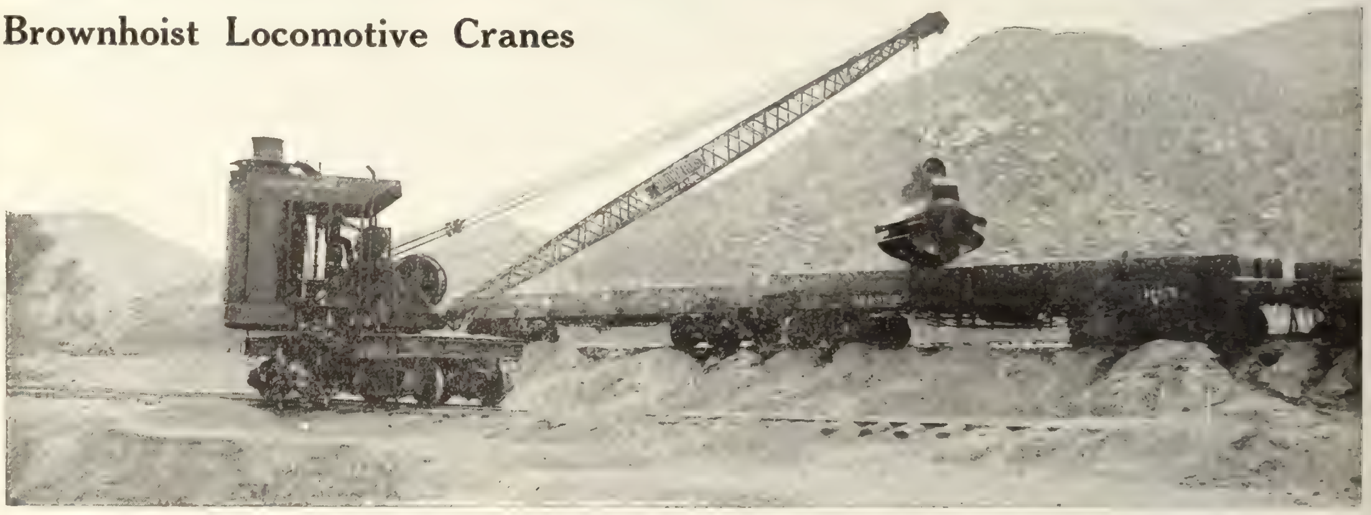

15-Ton Brownhoist Locomotive Crane used by the Independent Stone Co., San Diego, Calif.

If you handle stone, gravel, sand, coal, etc., you should investigate the use of Brownhoist Locomotive cranes for your work. Each crane, equipped with a Brownhoist Patent Grab Bucket, handles these materials 1 to 2 tons at a load, from and to stock pile, cars, boats, wagons and bins. And the crane also does the switching of the cars.

These cranes are being used in all sections of the country and you should investigate their operations.

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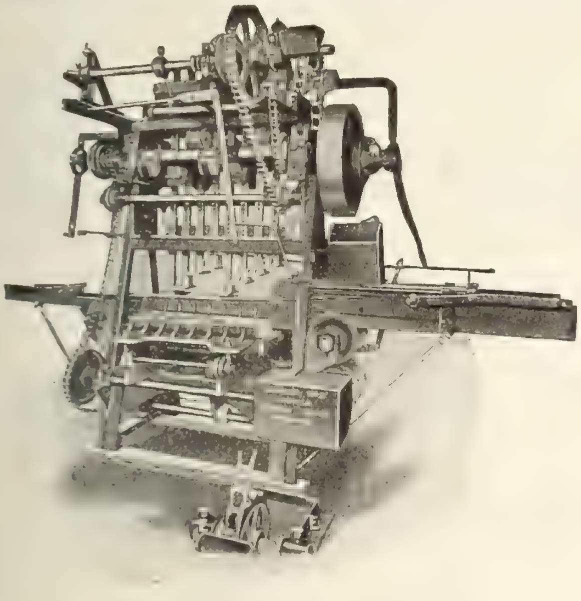
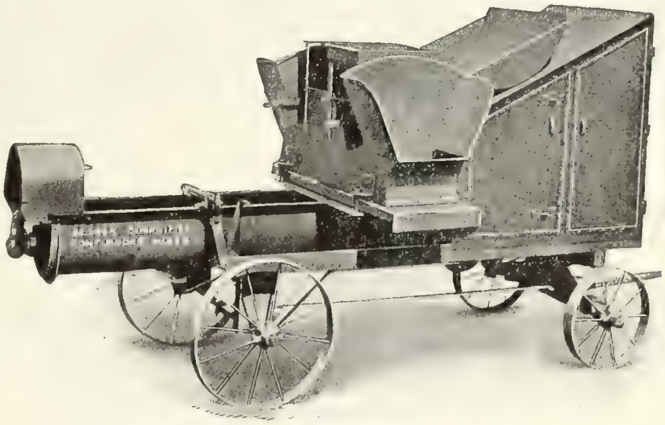


Besser Power Cement Brick Machine



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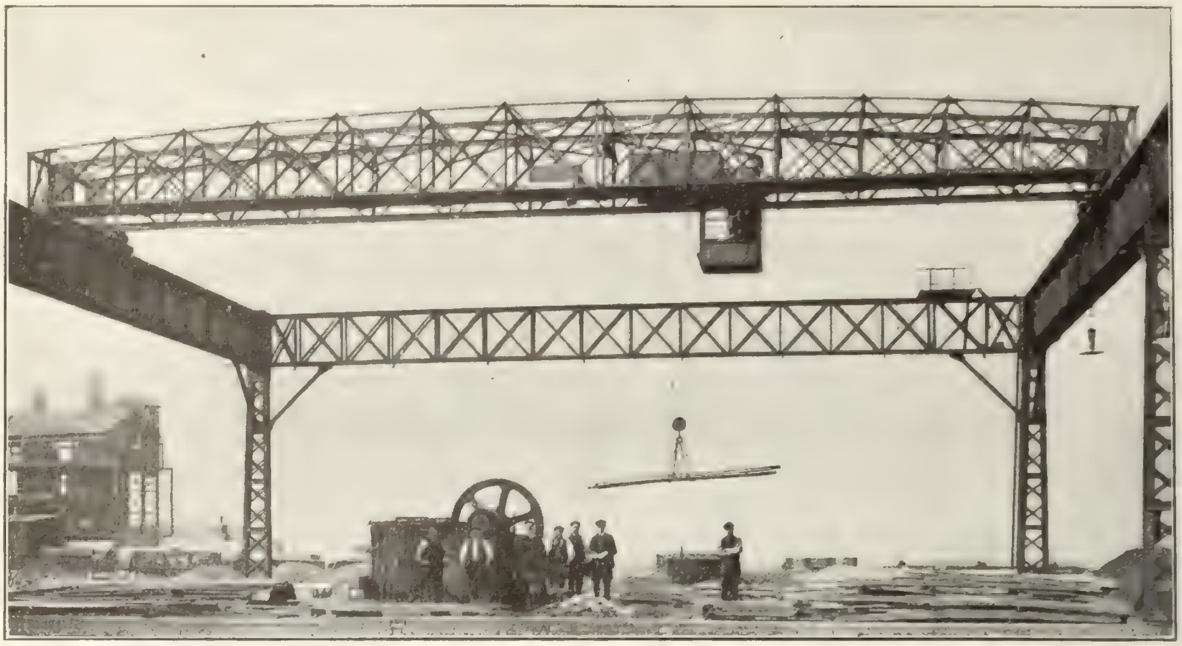

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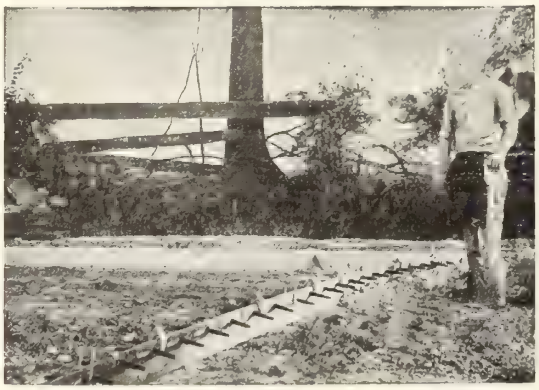

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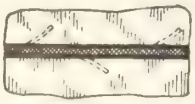
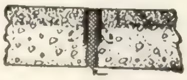


Longitudinal Section Showing Joint.



Cross-Section of Pavement Showing Expansion Joint.

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Wayne County's 70 Miles of Concrete Roads Prove that the Baker Plate Has Solved the Expansion Joint Problem.

"The only surface repair required on our concrete roads has been on the roads first constructed, where the joints were not protected with the 'armor' plates."

Extract from Sixth Annual Report of the Board of Country Road Commissioners, of Wayne County, Mich., Sept. 30th, 1912.

Our new system of installing Baker Armor Plates is simplicity itself, and holds the joint to perfect line and grade.

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Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

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Its Noiselessness; The rattle and bang of vehicles passing over its smooth surface absorbed and muffled till the quiet of the dirt road is obtained.

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We manufacture blocks of the highest possible standard, the very best materials only being used and in the Dominion Wood Blocks we believe we produce an article that has no equal.

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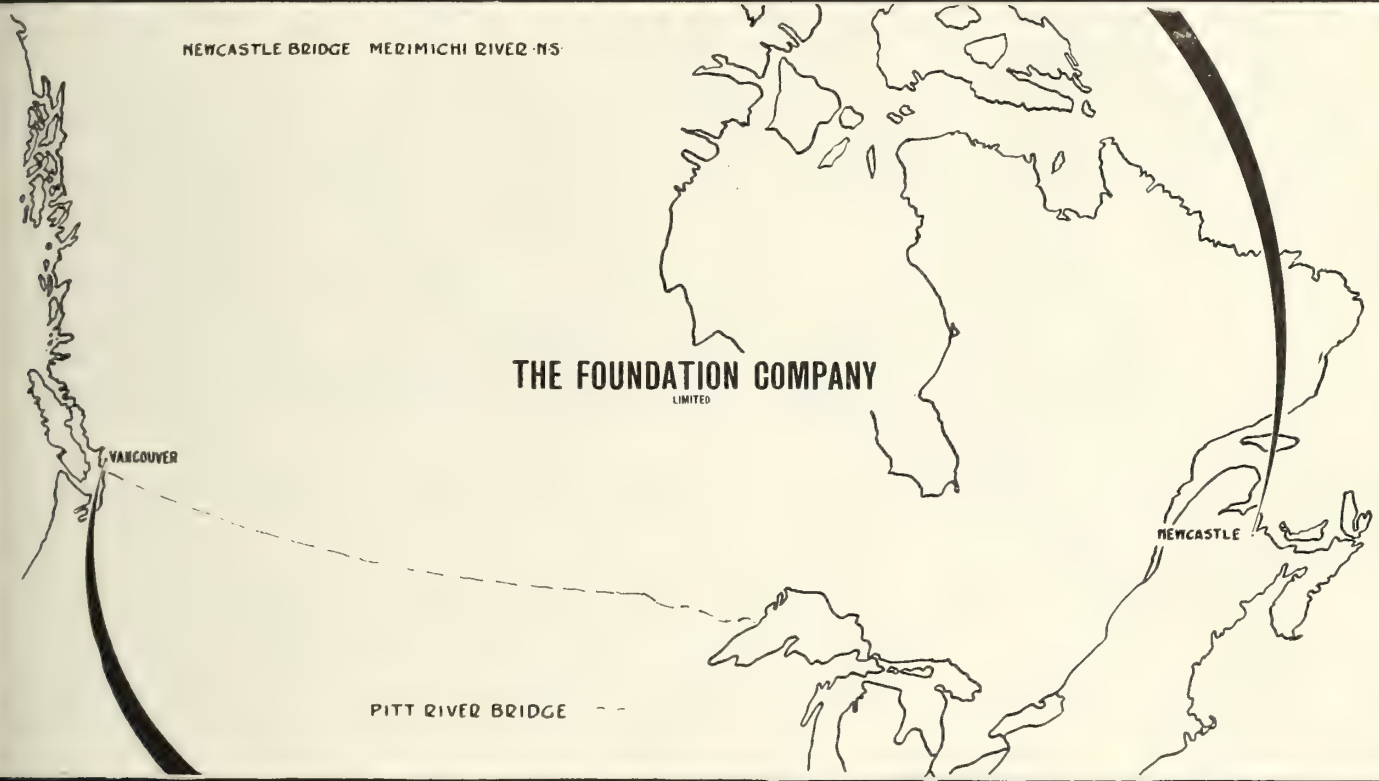
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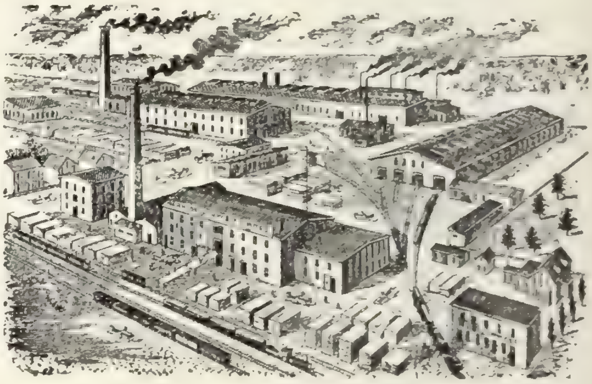

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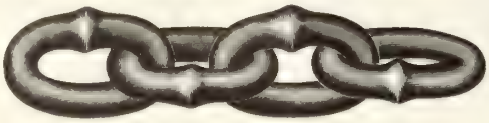

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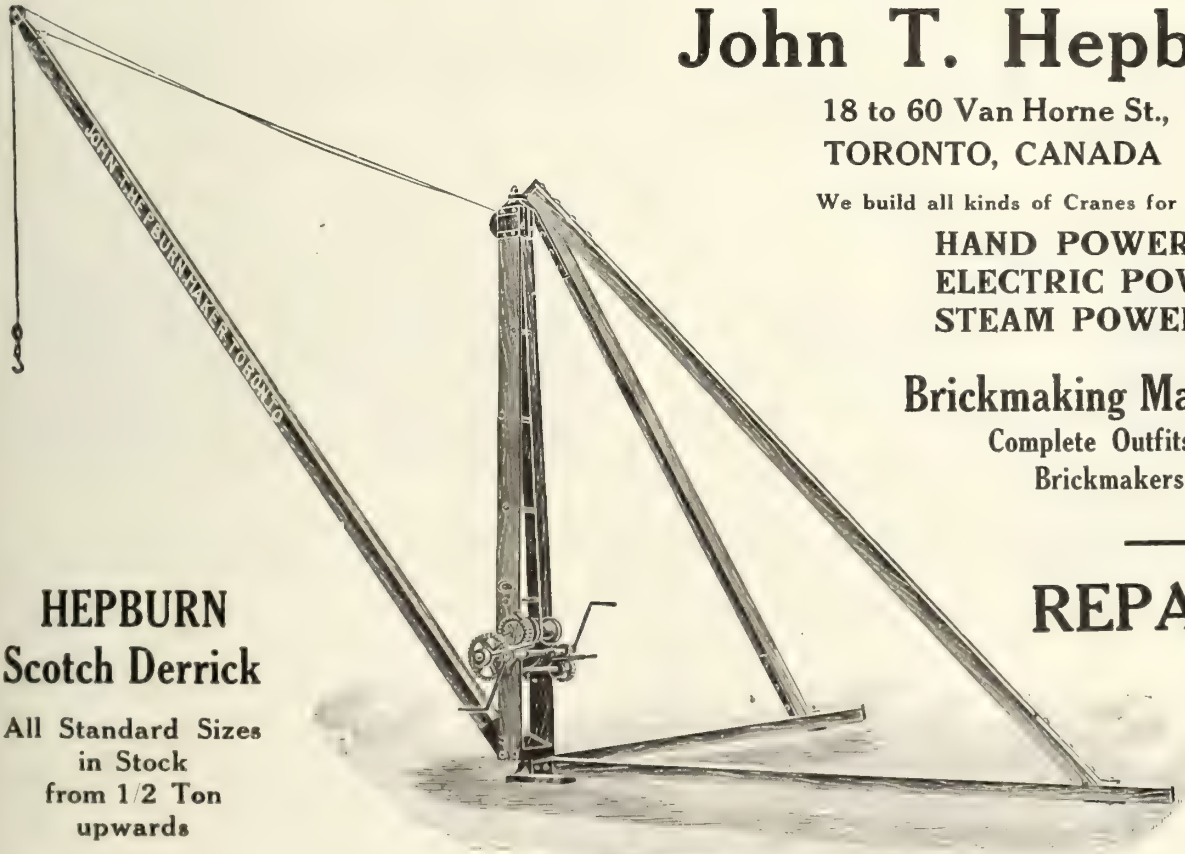
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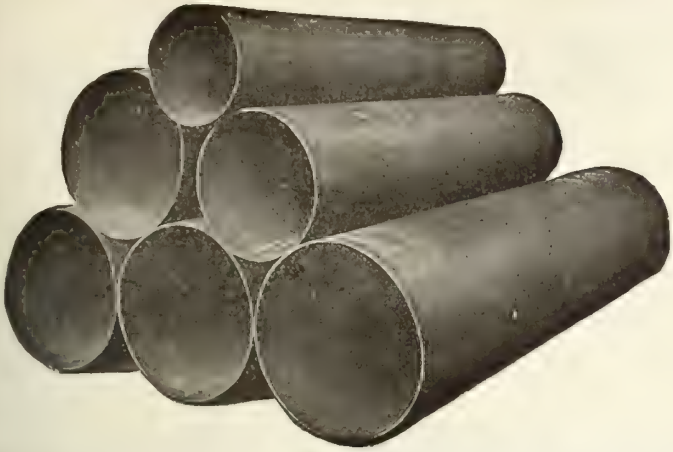

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have been used and approved by nearly all leading Engineers. They are undoubtedly the most economical means of storing water at an elevation.

We have built many of these in Canada, the United States and Mexico. Estimates cheerfully furnished.

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Bars, Angles, Plates, Beams, Channels always in stock for immediate shipment.

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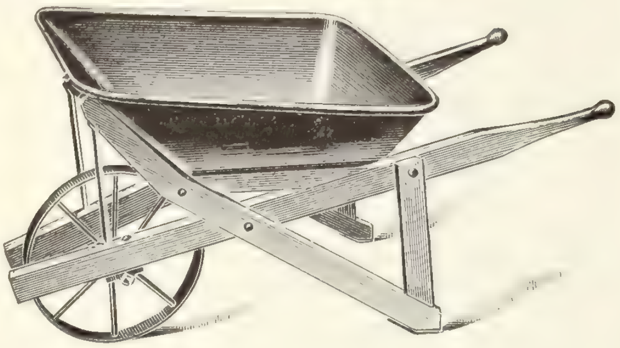

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SPECIALLY suited to the needs of contractors and workers on concrete. This barrow has a tray pressed from solid sheets of high carbon steel, without seams or joints. It can save much time and money on any concrete job.

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460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

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By using lime that is always of the same unvarying high quality. In short, use

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and you will save money and have a permanently clean-cut masonry job.

Try "Renfrew" on your next job.

Jamieson Lime Company

Renfrew, Ontario

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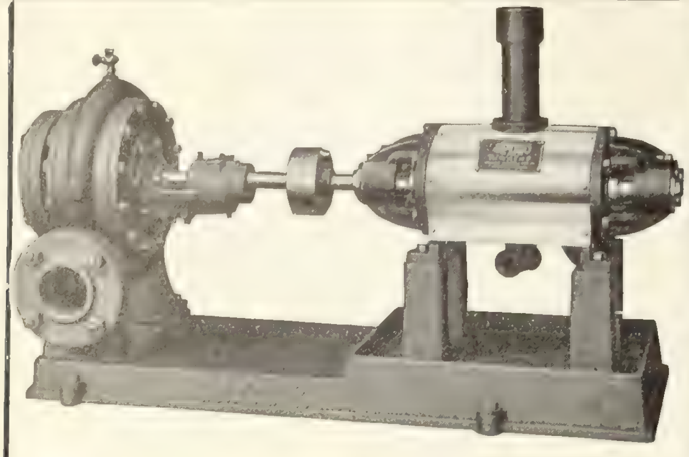
OUR EXPERIENCE — OUR STOCK — OUR MILLS

AT YOUR SERVICE

Heavy Yellow Pine and Fir Timbers up to 80 ft. on hand

James Sheppard & Son

Sorel, Quebec



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The remarkable performance of the Spiro turbine as applied to centrifugal pump drive, merely proves the old truth about the cardinal virtue of simplicity.

A gas producer yields a horsepower from the smallest quantity of coal, yet a steam operated Spiro-Centrifugal pumps a gallon of water at a much smaller total cost, figuring attendance, depreciation, investment and fuel combined.

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No one dreamed that a pair of plain herring-bone gears could be made into an engine or turbine before the advent of the Spiro. This new principle is revolutionary and has reduced prime mover construction to what would seem the limit of simplicity, service and economy combined. Not a single blade, nozzle or valve in the entire unit. Just a pair of herring-bone gears enclosed in a cylinder, with a jet of steam blown against them.

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make roofs that are handsome, *fireproof,* practically everlasting and moderate in price.

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makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely ***weather and fire proof.***

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Advantages of the Oil Engine

As gasoline is steadily rising in price, the cost of operating a gas engine is becoming a serious problem. You do not have to use gasoline, however. You can use oil and greatly reduce your power cost.

Fairbanks - Morse Oil Engines will operate successfully on 72 per cent. of the oils distilled from the average crude.

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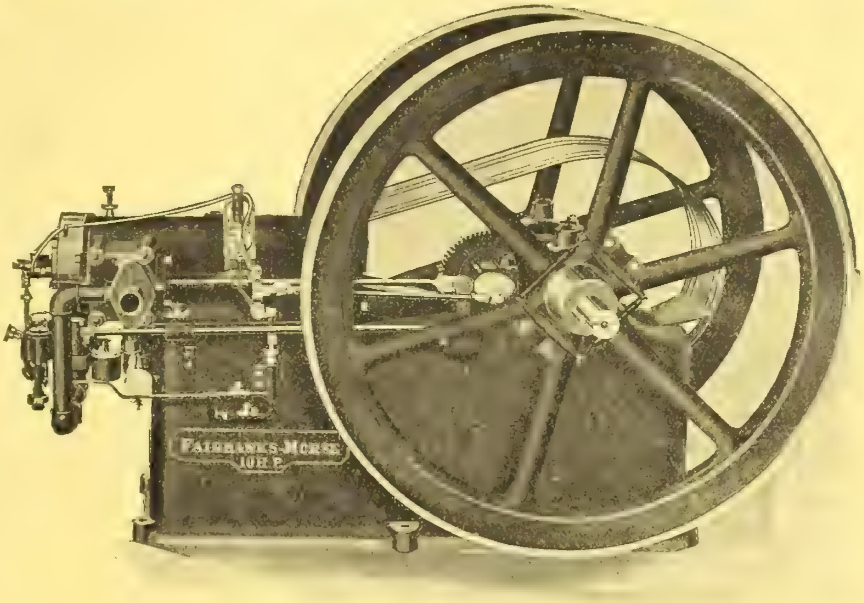

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"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"

Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

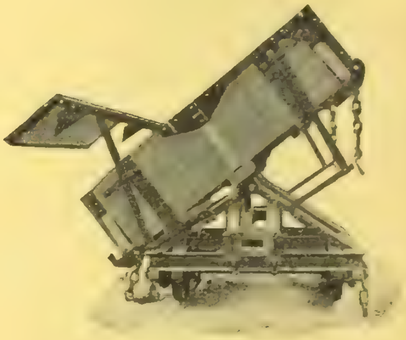
Brickyards, Quarries, Mines, Contractors, etc.

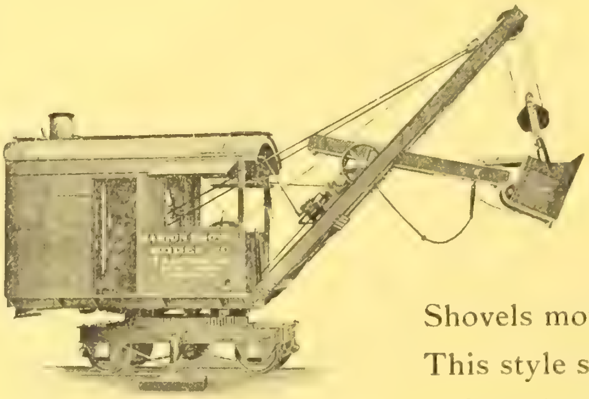
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.





"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes 5/8 - 1 and 1 1/2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines —Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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Vol. 27 Toronto, December 3, 1913 No. 49

ESTABLISHED 1886

Contract Record and Engineering Review

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PUMP
For Your
Special Needs

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Machine Co.,**
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"MADE IN CANADA"

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Made in all
Kinds of
Glass
on Short
Notice

Large Bent Plate Glass for Shop
Fronts a Specialty

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OF BELLISS MAKE
have gained their reputation for

- Simplicity of Design
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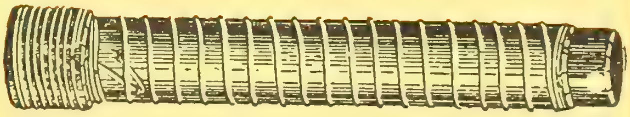

Continuous and Machine Banded Wood Stave
WATER PIPE
RESERVOIR TANKS
for city and town Water Systems,
Fire Protection, Power Plants,
Hydraulic Mining, Irrigation, etc.
One-half the cost of Iron Pipe—
and better.

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Full Particulars and Estimates Furnished

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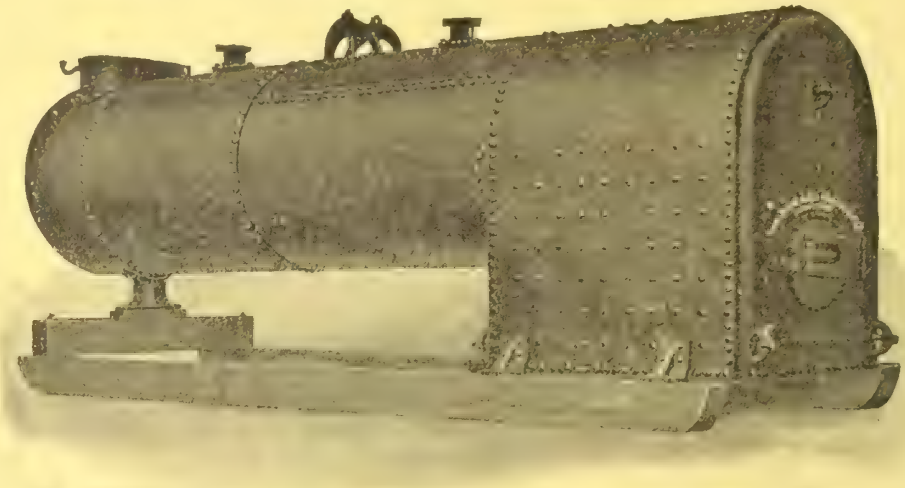
Portable and Stationary Locomotive Boilers for every phase of contracting work.



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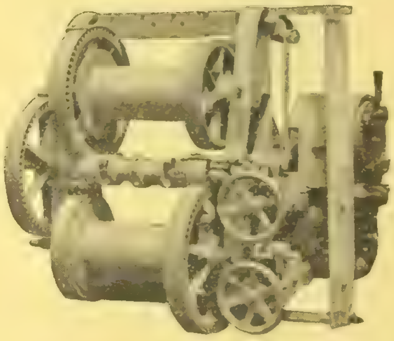

Compactness, Power, Speed, Safety

Are the main points of the superiority of the

"AMERICAN" Double Purchase Electric Crab

It is perfectly adapted for use in stone yards, foundry yards, structural plants, industrial plants, on railroad platform derricks, etc., where hoisting speed is not the most essential feature. It bolts to the mast the same as a hand power crab and is a great advantage where room is scarce.

The "AMERICAN" Electric Crab has a five horsepower motor, a line speed of twenty feet a minute, and lifts five thousand pounds on a single line. Its two drums are ten inches in diameter and twenty inches between the flanges.

This Crab is simple in operation and absolutely safe. To commence hoisting all that is necessary is to throw in a clutch and start the motor. When stopped the load is kept in position by an automatic mechanical brake on each drum. In case the current should be suddenly cut off the load cannot drop. If the current fails the crab can be operated by hand. We furnish a pair of cranks for this emergency. There are no hand operated dogs.

Lowering is by gravity and is controlled by hand brakes. There are no frictions. It is not necessary to release the brakes when commencing to hoist. This insures holding the load when hoisting is stopped. No wood whatever is used in the construction of this crab. It is made of steel and iron throughout. Steel pinions and clutches. Rawhide motor pinion.

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AMERICAN HOIST & DERRICK COMPANY

ST. PAUL, MINN., U. S. A.

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CANADA Portland CEMENT

SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
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CANADA
CEMENT
MONTREAL

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Canada Cement Company, Limited

Head Office - Montreal

Sales offices at

Montreal - Toronto - Calgary - Winnipeg

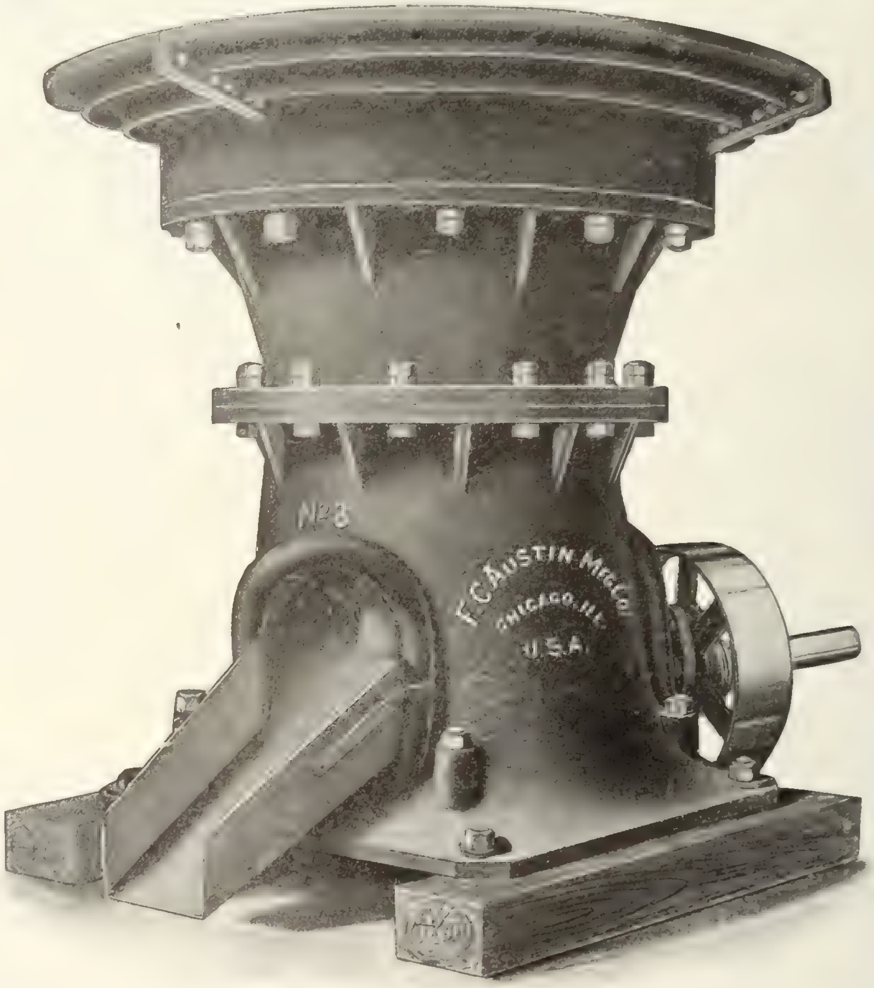
Buying a Rock Crusher?

If so—investigate the

Austin Gyratory Crusher

Strong
Durable
Large
Capacity

Made
in
Eight
Sizes



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COBALT, Opp. Right of Way Mine

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QUEBEC, 31 St. Louis St.
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Get the wagon that will not stall on the dump.

The

Austin Dump Wagon

Has a short wheel base, is low and has the greatest clearance beneath it.

The bottom boards oscillate freely in every direction.

They also raise automatically up the outside of the wagon box when dumped.

The discharge is complete, clean and rapid.

Until the automatic steel arms at the ends of the wagon are destroyed there can be neither crack nor crevice out of which sand or other loose material can leak.

The most perfect and practical wagon.

Particulars on request

Mussens Limited

MONTREAL 318 St. James Street
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  - Can. Ingersoll-Rand Co., Ltd.
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  - Gartshore-Thomson Pipe Co.
  - Kerr Engine Company

(Continued on page 12)

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Royal Bank
Building,
Toronto,
To be
Fireproofed
Throughout
With
Don Valley
Porous
Terra Cotta
Fireproofing

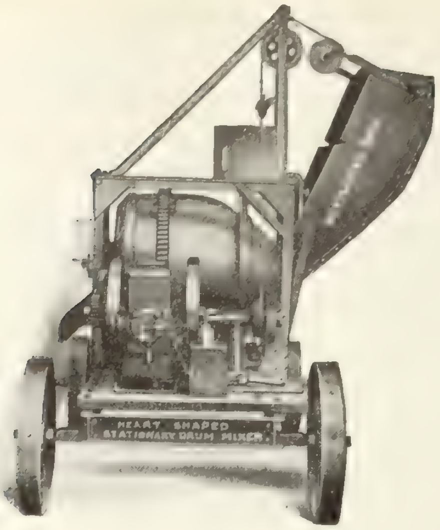
The Largest Contract For Porous Terra Cotta Fireproofing

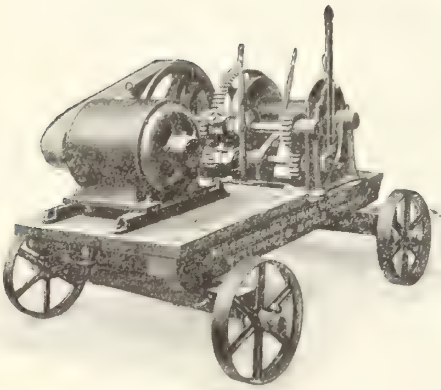
The largest contract ever placed for one building in the British Empire has been made for

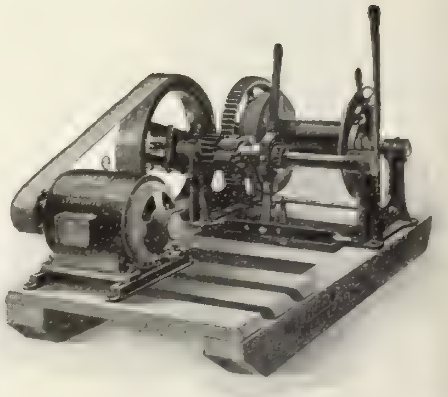
Don Valley Porous Terra Cotta Fireproofing

to be used in fireproofing the Royal Bank Building, Toronto.

Don Valley Brick Works,
Limited,
Toronto, Ont.







The Wettlaufer Line

The Wettlaufer Line of Hoists and Concrete Mixers embodies all those qualities which go to make up perfection in these two lines of manufacture.

Wettlaufer Hoists are made in fourteen different types and sizes to fill every possible condition from the smallest to the largest job. The Hoists illustrated are electrically driven, while some of our models are mounted with the famous Wettlaufer Gasoline Engines, and the power depends entirely on the load they have to lift and the speed at which our customers wish them to run. The results attained by users of the Wettlaufer Gasoline Engine all over Canada lead us to affirm that one of our Hoists will save you from 60 to 80 per cent. as against the old method of hoisting your material.

The Wettlaufer Concrete Mixer which has many exclusive features, including the Heartshape Drum and Horizontal Tubular Boiler, is guaranteed the fastest and most thorough mixer ever produced. We claim that our machine will, in a given time, deliver a greater number of yards of perfectly mixed concrete than any other mixer on the market.

We invite you to attend the dail demonstration at any of our branches.

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

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Rogers' Portland Cement

AND CRUSHED STONE

Concrete Arch Bridge of Embro, Ont., built with Rogers' Cement

C. E. URE, Woodstock, ENGINEER **BAIN & ROSS, Embro, CONTRACTORS**

Cost price $4,200. Length of span 75 ft. Total length of bridge, including wings, 120 ft. Ten tons twisted bars used in reinforcment.

Rogers' cement is the most dependable for all types of construction and engineering-contracting work—especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, etc.

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

CRUSHED STONE

Our crushed stone is free from dust, dirt and mold—it is really clean stone—properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

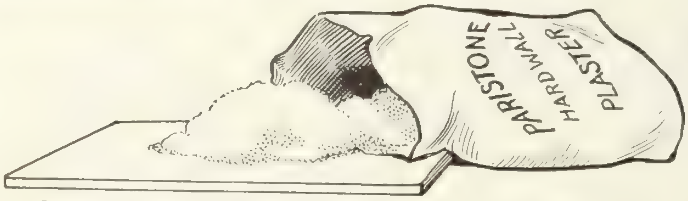
Paristone *Hardwall* Plaster

Owner
is
Satisfied

Makes good friends

Because it has the reputation of good setting qualities and makes the strongest wall

Builder
is
Satisfied

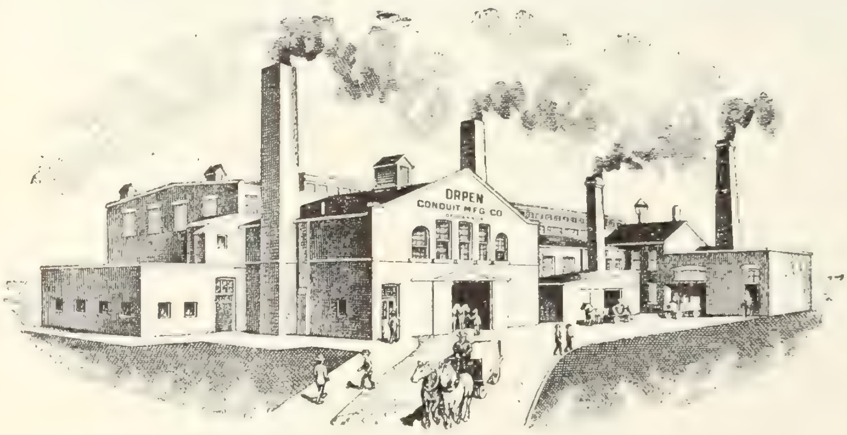


Sold where You see this Trade Mark →

THE ALABASTINE CO LIMITED
OFFICE-PARIS ONT. MILLS CALEDONIA ONT.
PLASTER PRODUCTS

Grey gypsum makes the best plaster. We own the only mine of this rock in Canada, hence the superiority of "Paristone."

THE ALABASTINE CO., LIMITED PARIS, ONTARIO



ORPEN CONDUIT MANUFACTURING Co of CANADA
XCELADUCT
ORPENITE
CONDUITS
TORONTO ONTARIO

The Sign of Good Conduit

"Xceladuct" and "Orpenite" Conduit

"Xceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

"Orpenite" Enameled Conduit—Easy Bending Spellarized Steel Tube; protected against rust by coatings of special enamel not affected by temperature conditions, smooth interior.

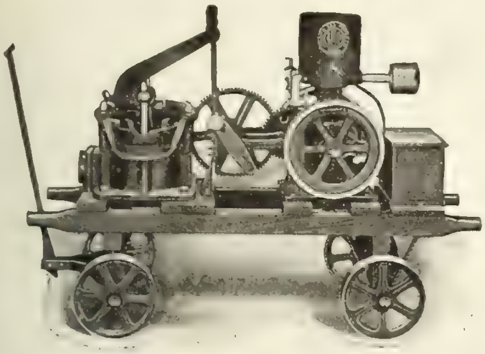
We solicit an opportunity to submit prices and other particulars.

Orpen Conduit Manufacturing Co. of Canada

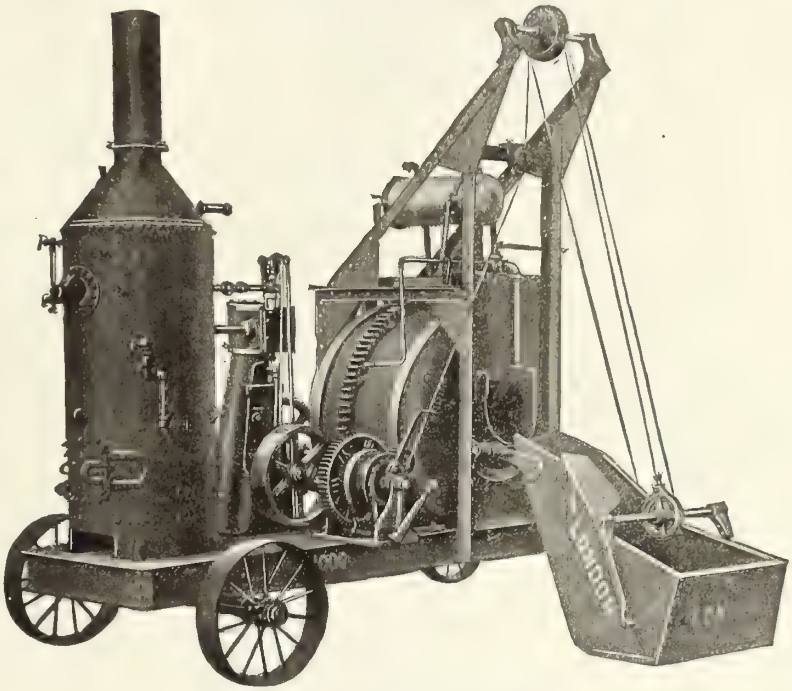
TORONTO, CANADA Montreal, Quebec

Before You Buy Concrete Machinery

or Equipment of any kind, write us for our 180 page catalogue.



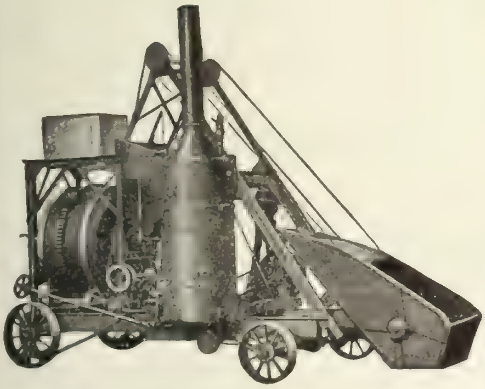
Power Diaphram Pump



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

We are the largest manufacturers of Concrete Machinery in Canada.



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

We do not build machinery down to a price but up to a standard.

London Sill Step and Window Cap Mould

A few lines we manufacture—

Concrete Mixers, Mortar Mixers, Tile Moulds, Drain Tile Machines, Side Walk Tile Machines, Cement Block Machines, Cement Brick Machines, Sill Step and Window Cap Moulds, Gasoline Engines, Screens and Elevators, Fence Post Moulds, Hoisting Engines, Material Elevators, Concrete Carts, Wheelbarrows, Scrapers, Sidewalk Forms, Pumping Outfits

A complete line of Contractors' Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

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We are the Largest Manufacturers of Concrete Machinery in Canada.

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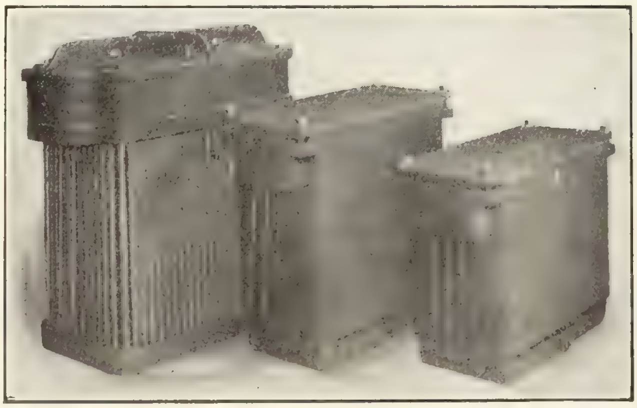
(Continued on page 14)

Power Logic

Reduced Loss
Increased Profit — Ferranti Transformers



Three Phase Pole or Station Transformers

The Transmission line that is equipped with Ferranti three phase transformers is always a profitable one because of the great reduction in energy-loss made possible by these efficient transformers.
All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

Three phase transformers are the most economical type to operate and will effect a considerable saving in construction cost.

Write us for particulars

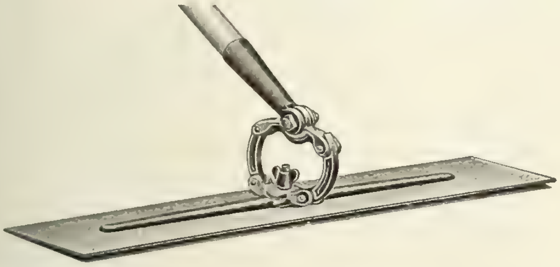
The Ferranti Electrical Co., of Canada, Limited
TORONTO
90 Sherbourne St.
WINNIPEG
56 Albert St.

SAVE 75%

of

TIME, LABOR and EXPENSES
on your Sidewalk Construction Contract by using.

Abram Cement Tools



"Abram" Sidewalk Finishing Tools are sold on the **Guarantee** that **ONE MAN** can do more work with them than **THREE MEN** can do with ordinary tools. This means if Finishers get $4.00 per day, you save the wages of **TWO MEN**, or $8.00 per day, by using **"Abram"** Tools. We positively guarantee this result. Let us prove it to you. Circular.

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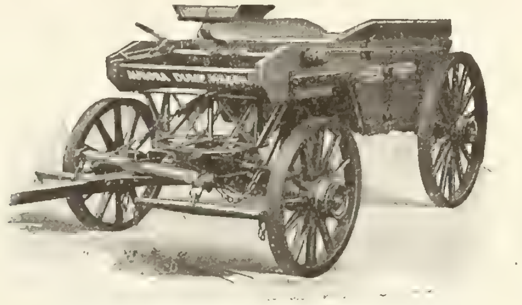

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The Toughest Stone for Macadam in Ontario

Record of Logan Avenue, Toronto, Macadamized from Queen St. to Gerrard St., in 1902

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1904	3.30	1909	200.46
1905	9.35	1910	14.07
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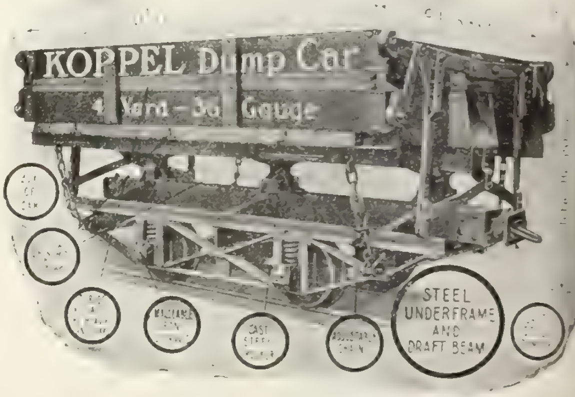
What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

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Barrett Specification Roofs are roofs of coal tar pitch and tarred felt, with a top surface of slag, gravel or tile, *laid according to the Barrett Specification.*

This specification is simply the standard formula for building a first-class roof of this character.

It is possible, of course, to make an inferior roof of these materials either by poor workmanship or by using insufficient and poor goods. But if the Barrett Specification *is followed absolutely and the materials called for are used,* you are certain of getting the best value in roof coverings.

Such roofs usually last twenty years and over without leaks or repairs.

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General Contractor: C.E. Deakin
Roofers: Campbell & Gilday

Special Note We advise incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested. ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

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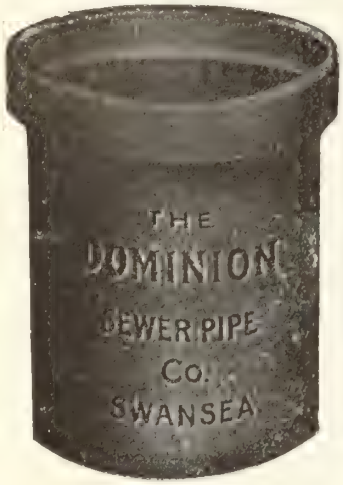

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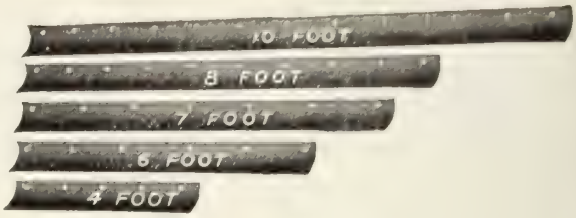

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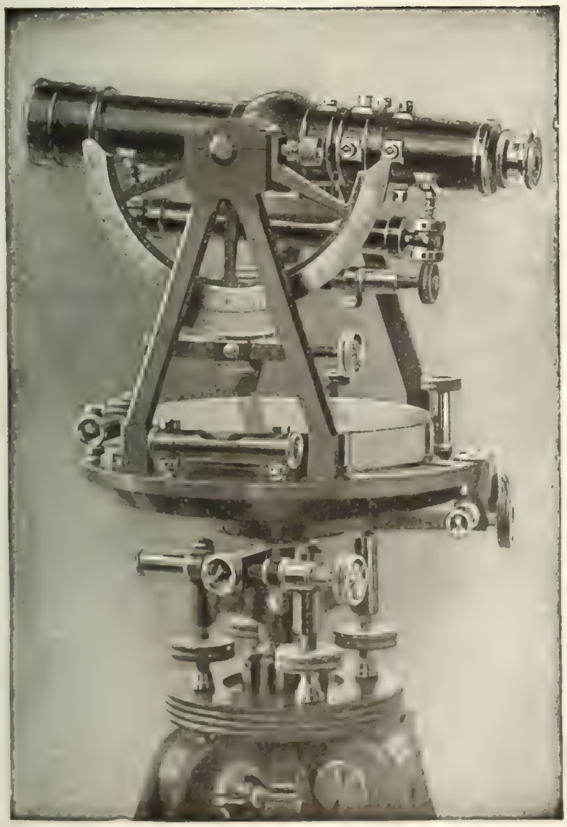

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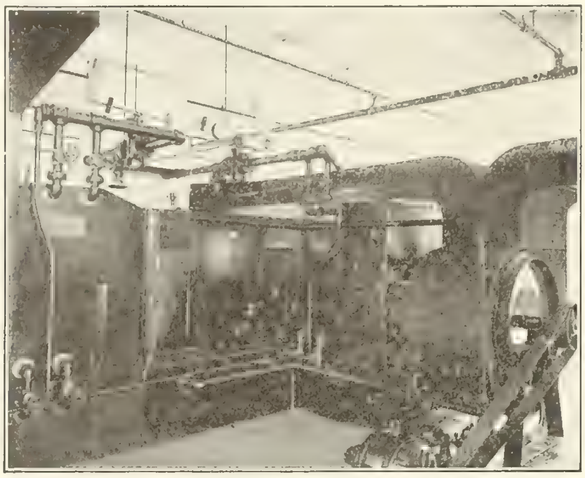

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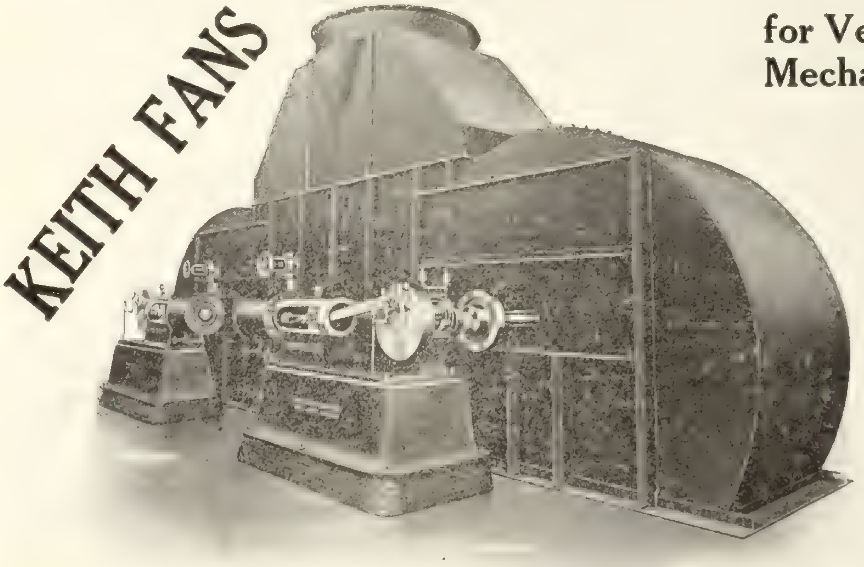

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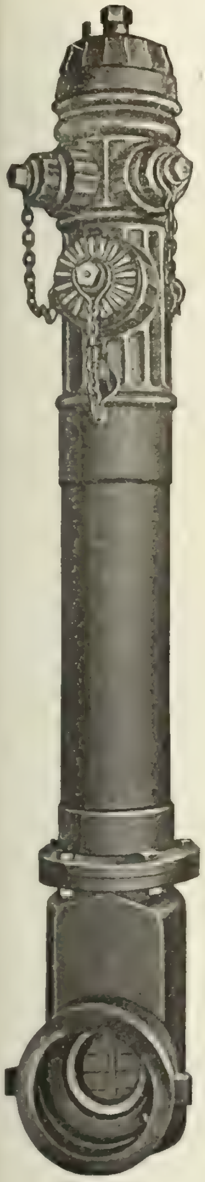
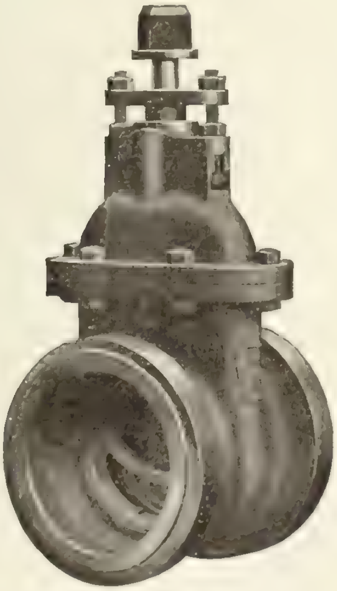


Kerr Gate Hydrant.



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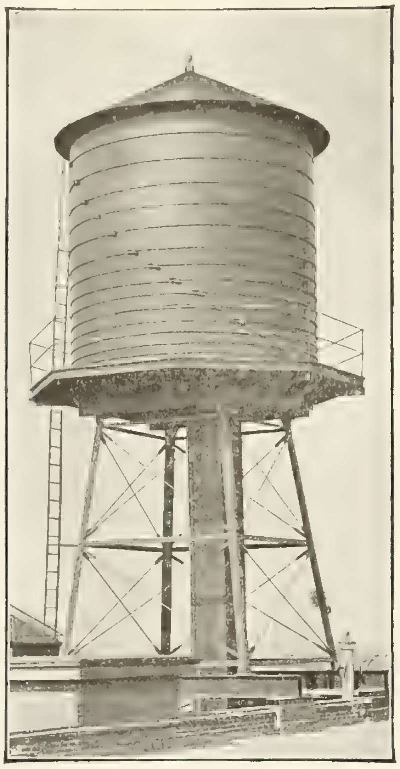

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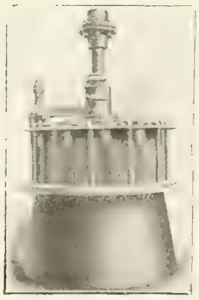

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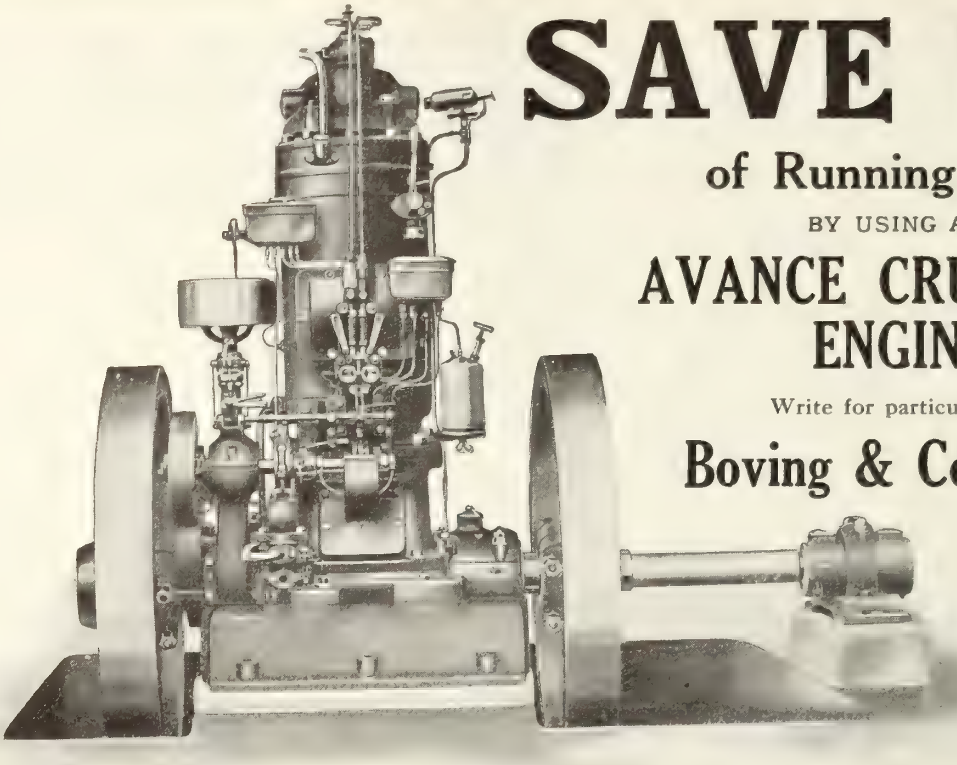

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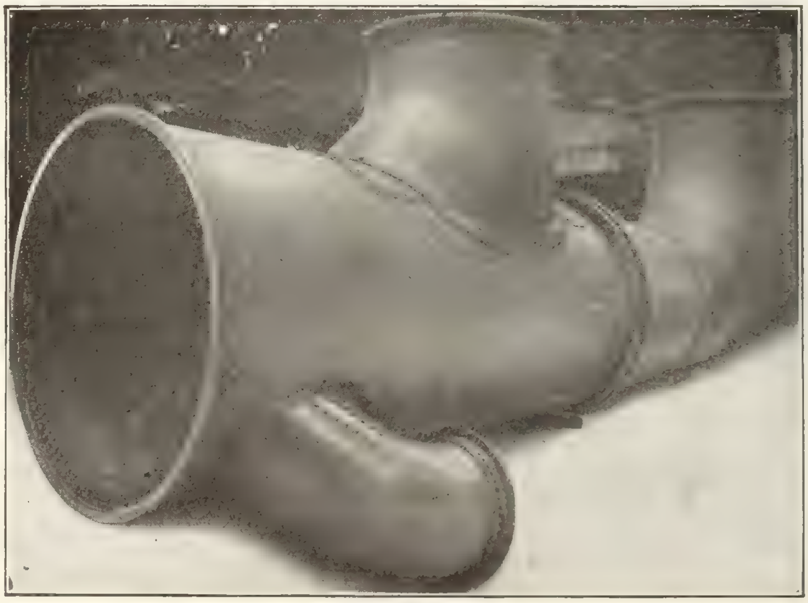

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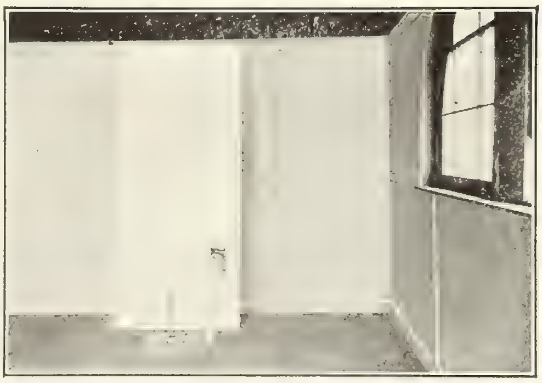

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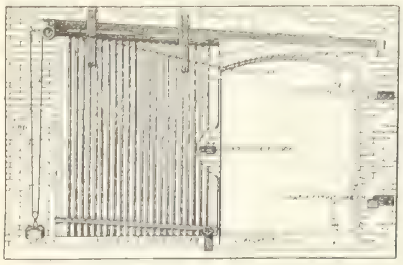

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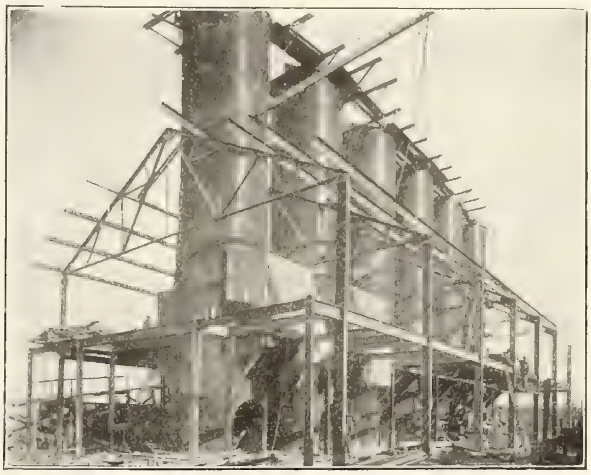
Economy in Lime Burning



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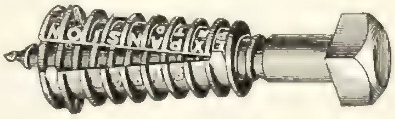

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are non-rusting. They are used for fastening small fixtures of all kinds to marble, tile, etc.

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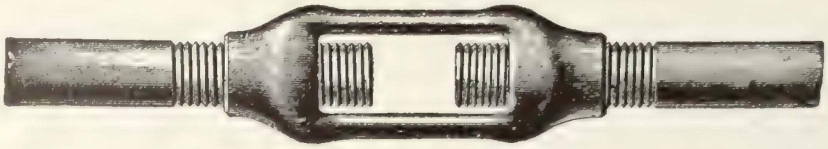

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Twisted Steel Bars
FOR REINFORCING CONCRETE

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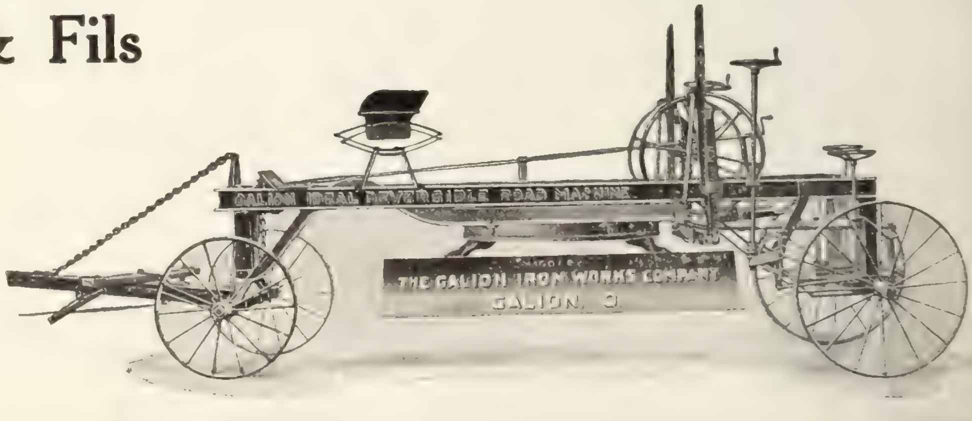
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THE GALION IRON WORKS COMPANY
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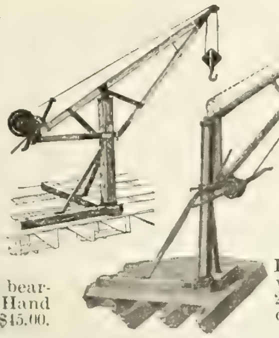

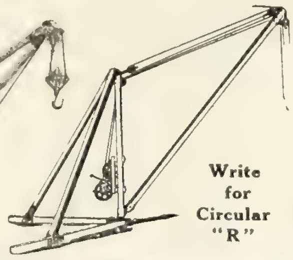

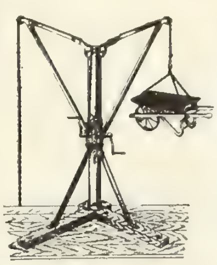

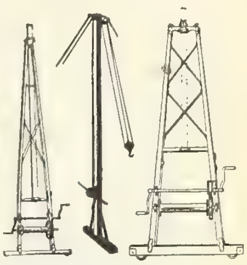

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DOUBLE BOOM WHEELBARROW DERRICK full circle swing. Sufficient chain for 3 story building. PRICE $68.

"A" FRAME BUILDERS' DERRICK 1800 lbs. capacity $48.00; 2500 lbs. capacity $51.00.

T. P. SETTER DERRICK.
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At these prices you can't afford to be without one of these derricks. THEY SAVE TIME, AND THAT MEANS MONEY. CONSULT US BEFORE PLACING YOUR ORDER. SATISFACTION AND PROMPT SHIPMENT GUARANTEED.

Don't Hire Men to Carry Up Your Material, Hoist It with a SASGEN DERRICK.

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For Reinforcing Concrete
Plain Rounds Squares
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We can ship from stock

Ask for prices—they will interest you.

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Angles from ¾ x ¾ in. up to 2 x 2 ins.
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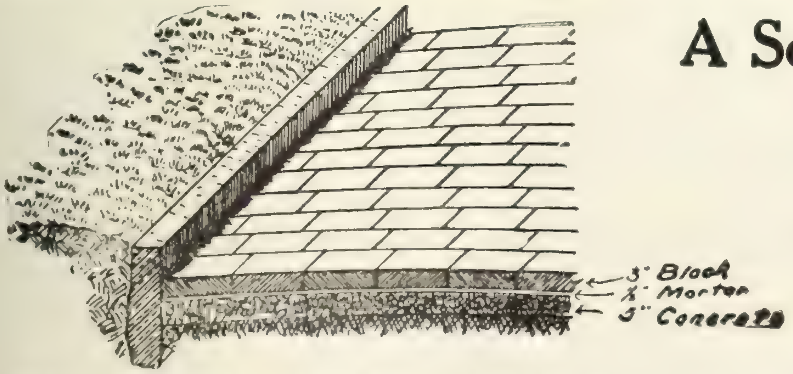

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Non-Absorbent and nearly Noiseless.
Unaffected by extremes of Temperature.
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Easily Repaired and easily Cleaned.

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Asphalt Block Pavements
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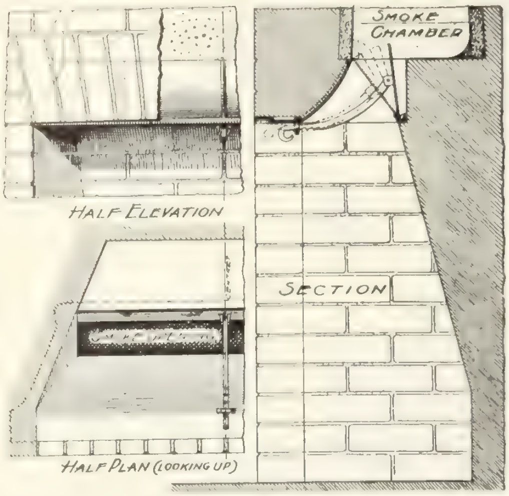

Forms Lintel to Support Brickwork.
Presents Smooth Surfaces to Lead Smoke to Flue.
Simplifies Mason's Work and Saves His Time.
Provides Valve to Regulate Draft and Ventilation.
Simply and Strongly Constructed.
Cannot Get Out of Order.
No Complicated Regulating Gear nor Piercing of Brickwork for Operating same.

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Seamless and Lapwelded Steel Spigot Pipe

WE CLAIM PRE-EMINENCE ON THE SCORE OF

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SOLICIT YOUR ENQUIRIES AND SPECIFICATIONS

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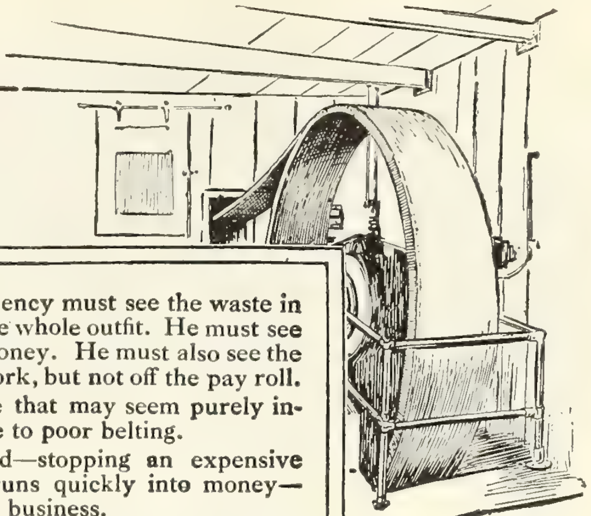
When the gang draws pay for loafing



THE Millman who is studying for efficiency must see the waste in using Belts that go wrong—tying up the whole outfit. He must see the waste of precious time—which is money. He must also see the loss entailed by a gang being thrown off work, but not off the pay roll.

A cheap belt piles up a bill of expense that may seem purely incidental—but which is directly attributable to poor belting.

A belt runs slack and must be fixed—stopping an expensive machine, wasting the men's time which runs quickly into money—often falling down on deliveries and losing business.

A Goodyear Belt will not run slack—Because it will not *stretch.*

In the making of Goodyear belting, the many plies of hard-fibre cotton duck—each thoroughly permeated with rubber "friction"—are compressed into a solid combination of strength and grip.

The Goodyear "curing" or vulcanizing is done while the Belt is stretched to its utmost limit by special machinery. All tendency to stretch in service is taken away. That is why Goodyear Belts do not *stretch* in service.

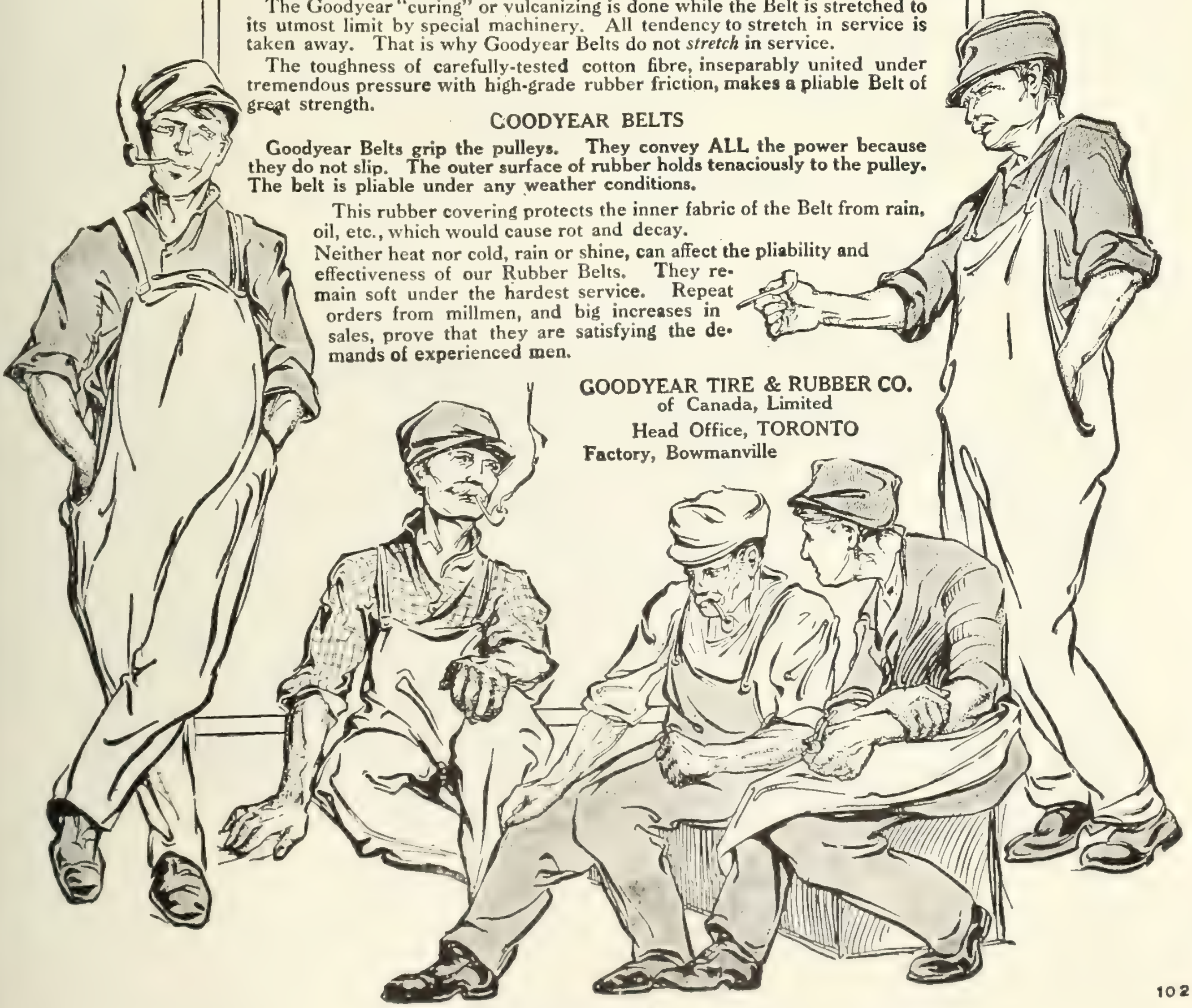
The toughness of carefully-tested cotton fibre, inseparably united under tremendous pressure with high-grade rubber friction, makes a pliable Belt of great strength.

GOODYEAR BELTS

Goodyear Belts grip the pulleys. They convey ALL the power because they do not slip. The outer surface of rubber holds tenaciously to the pulley. The belt is pliable under any weather conditions.

This rubber covering protects the inner fabric of the Belt from rain, oil, etc., which would cause rot and decay.

Neither heat nor cold, rain or shine, can affect the pliability and effectiveness of our Rubber Belts. They remain soft under the hardest service. Repeat orders from millmen, and big increases in sales, prove that they are satisfying the demands of experienced men.



GOODYEAR TIRE & RUBBER CO.
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Head Office, TORONTO
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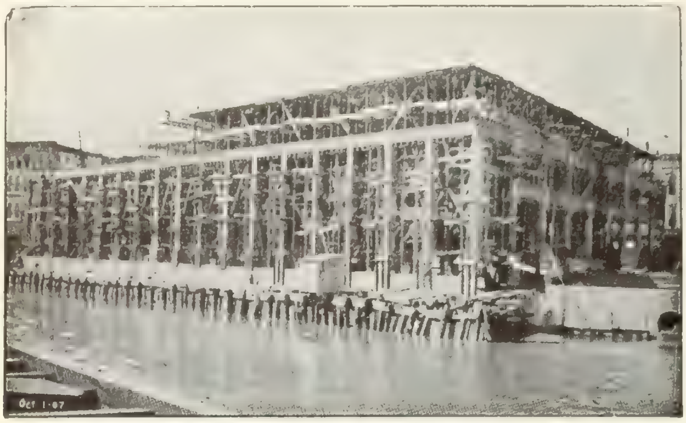
VICTORIA, VANCOUVER, EDMONTON, CALGARY, REGINA,
WINNIPEG, HAMILTON, LONDON, TORONTO, MONTREAL, ST. JOHN, N.B.



The Bostwick Brown Building

A Test of "MEDUSA" WATERPROOFING

The basement floors of the building illustrated are 20 feet below the surface of a river. These floors and walls are of concrete, waterproofed by "Medusa" Waterproofing. The result is a perfect dry basement and one which will always be dry. Surely this is a severe test of a waterproofing compound.

Send for Samples and Prices.

Manufactured under Canadian Patent controlled by

STINSON-REEB BUILDERS' SUPPLY CO., LIMITED

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Architects, Page & Warrington. North Toronto High School Contractor, T. Palmer.

Sun Bricks were used in this building because of their exceptional hardness, uniform color and general first-class quality.

SUN BRICK CO., LIMITED - TORONTO

Works: Don Valley **Head Office: Traders Bank Bldg.**

ESTABLISHED 1886

Contract Record and Engineering Review

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Alphabetical Index of Advertisers
Page 16

Vol. 27 December 3, 1913 No. 49

Canada's Financial Position Fundamentally Sound

NEVER yet has a cloud appeared on the horizon but some gloomy weather expert has predicted a storm; never has money been tight in any country but gloomy financiers have foreseen a state of general bankruptcy, the country "going to the dogs," and so on. To counteract the influence of this exaggerated pessimism it is necessary perhaps to indulge in somewhat exaggerated optimism. The one is an infinitely greater constructive force than the other. Optimism sets up ideals and transmits the enthusiasm to work for them. Pessimism robs a man, a community and a nation of even that which they seem to have.

Looking around we find plenty of ground for optimism. Sir Frederick Williams-Taylor, the new general manager of the Bank of Montreal stated recently that the key to the financial situation in Canada was to be found in the attitude of London towards the Dominion. If we place confidence in this authority, and if we appreciate the extent of Canada's indebtedness to England, it is gratifying to note the success of the Montreal city loan of $7,500,000. The subsequent quotation at a premium of ¾ of one per cent. indicates a vastly improved sentiment in England towards Canadian affairs.

Sir Frederick Williams-Taylor, to whom we have referred above, interviewed recently upon his return to London after a visit to Canada, emphasized his opinion that Canada's financial position was financially sound and that all outward indications justified her in proceeding with the utmost confidence. He characterized London's attitude toward Canada as "watchful to a degree, with enthusiasm in a state of suspended animation." The observation is a significant one—one that urges a sane and conservative yet confident policy on our part.

The over-subscription of Montreal's seven-thousand-dollar loan in London is of outstanding importance as indicating restored confidence. This reassuring effect upon England's financial interests is attributed largely to the first-hand information taken back to London by the new general manager of the Bank of Montreal, whose word, for many years, has carried weight in quarters where Canada's financial interests are most concerned. Here, in authoritative places, the opinion is expressed freely that with the lessons of the past there will follow, an advent of easier money, which should be due with the passing of 1913, a period of sound enterprise and greater constructional development than ever. The change in the attitude of British investors demonstrated during the last month is not the least of the factors which will bring about a further strenuous era of building activity.

British Investments in Canada

IN the previous article passing reference is made to the subject of British investments in Canada. In this connection it may be interesting to give the following extracts from a speech delivered by Sir George Paish, Editor of the London Statist, when in New York last month:

"Canada for a long time to come will have to depend upon foreign capital—I would say almost entirely upon British capital—for the major portion of the capital supplied to Canada comes from the United Kingdom. I was delighted to hear Mr. Foster (the Acting Premier of Canada) say that the United States had provided $20,000,000 for the development of Canada. You will, I am sure, be interested to know that the mother country of which you are all so proud, has provided Canada with a sum of considerably over £400,000,000.

"You all know, of course, that the mother country has supplied almost the entire capital needed for construction of the railways of Canada, and that the prosperity of Canada has resulted mainly from the construction of those railways. The opening up of those vast lands in the West, and the cultivation of that great wheat area are bringing to Canada an amount of wealth difficult to calculate. I remember when I was here on the occasion of my last visit four years ago, the wheat production of Canada was only about one-half of what it is to-day. And we are now looking forward to Canada producing wheat possibly for the people of the United States, but certainly the greater part of the wheat we ourselves need in the mother country.

"You will, of course, appreciate that the investments of the United Kingdom in Canada are not entirely philanthropic. We put our money there for the purpose, first of all, of getting interest upon it. But underlying that is this point, that we put our money into Canada in order to supply the British people with the food they need for their subsistence. I need scarcely say that we also put our money in other countries for the same purposes. You will perhaps be interested to know that the greater part of the capital provided for the construction of railways in all the young countries of the world is supplied by the investors of the United Kingdom. It is essential for the welfare of our people that we should do so. I think the amount of capital we have provided for railway construction in the agricultural countries of the world is $2,000,000,000, a very great sum, but it is upon the supply of food that the prosperity of the mother country depends, and it is of the greatest importance that we should supply capital for the development of Canada, Argentine, Brazil—indeed of all countries, I would say, even of the United States, for the purpose of insuring for ourselves the food and raw material we need. The fact that the United States sells to Canada so great a quantity of goods is in part due to the fact that British capital flows so freely into Canada. Briefly expressed the position in the United Kingdom is as follows: We supply the capital, America in large measure supplies the goods, and Canada obtains the advantage.

"During the last two years, Canada has made unexampled progress, but I think the progress is small in comparison with the progress that will be made in the future. Perhaps for a few years it may be necessary for Canada to go rather slow, but that will prove to be only a period of recuperation and of preparation for a much greater advance in the future."

The Wall Street Journal remarks that the United States has $600,000,000 invested in Canada.

The Story of a Wayne County Concrete Road

THE success which has attended the activities of the road Commissioners of Wayne County has made that section of the state of Michigan famous. Concrete has been adopted as the standard construction and all other forms have been abandoned. The Commissioners defend their selection of concrete on the ground of the general satisfaction derived from it and the low cost of maintenance as compared with other types. The concrete roads of Wayne County have attracted thousands to that locality, engineers, contractors and municipal authorities from all parts of Canada and the United States having gone there to study methods and results. The recent American Road Congress, which lasted a week, was held in Detroit, it being generally considered that the city and its environs offered the most useful object lessons to the delegates.

The story of a Wayne County Concrete Road is told in the Seventh Annual Report of the Commission and reproduced below in extenso. We are indebted to Mr. Edward N. Hines, Chairman of the Wayne County Road Commission, for the accompanying illustrations.

"After investigating a road with regard to traffic conditions, distances between objective points, number of people in the locality, etc., we recommend to the Board of Supervisors at their annual October session that the road be adopted and improved as a county road. The Board of Supervisors rejects, alters or adopts our recommendation. If the road is adopted, a record is put into our minutes setting forth our determination to take over the road as a county road; the road is given a name, usually the one by which it is known locally; that portion of our minutes showing our determination to adopt the road is published for three successive weeks in some newspaper having a circulation in Wayne County, and served upon the officials of the township in which the road is located. The road then becomes a county road with full authority vested in the county to improve and maintain it. A survey is made, plans and profile prepared, and these together with specifications and application for state reward are filed with the State Highway Department. Bids are asked for by advertisement (a prefunctory proceeding, as we have not contracted for any road construction for several years, nor have any proposals been received) which when they are received, we have the authority to accept, awarding the contract to the lowest responsible bidder, or to reject and do the work by day labor.

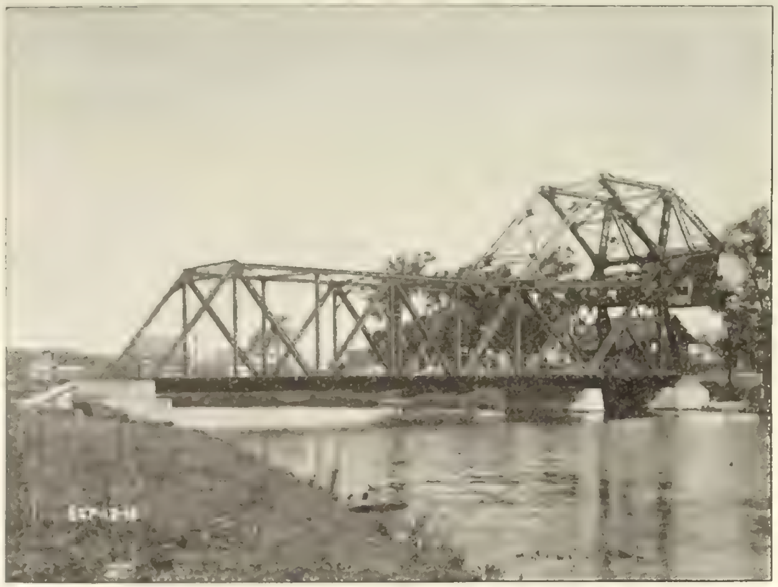
"After the road has been staked out, we prepare and shape the subgrade doing the major portion of such work with scarifiers and graders, the hauling power for which is furnished by steam engines or rollers. Careful attention is given the grade to eliminate soft spongy places, and a ten ton roller is used to roll it hard. To produce a good concrete road, thorough drainage is necessary in addition to a good subgrade. Both proper grade and drainage are difficult to cope with in Wayne County as the county for the most part is flat and situated in a valley not easily drained. The subsoil is largely of heavy sticky clay with some loose, deep sand.

"The hauling to the subgrade is done either by teams or with large cars hauled behind a roller or other trailer. These cars each hold seven tons of stone or sand. Materials are unloaded wherever conditions permit by means of steam shovels, and construction work progresses toward the base of supplies. We stock materials in the fall so that breakdowns and car shortages at the gravel pits will not interfere with spring work after getting under way. Camps are established wherever necessary in which the men are housed and fed at cost.

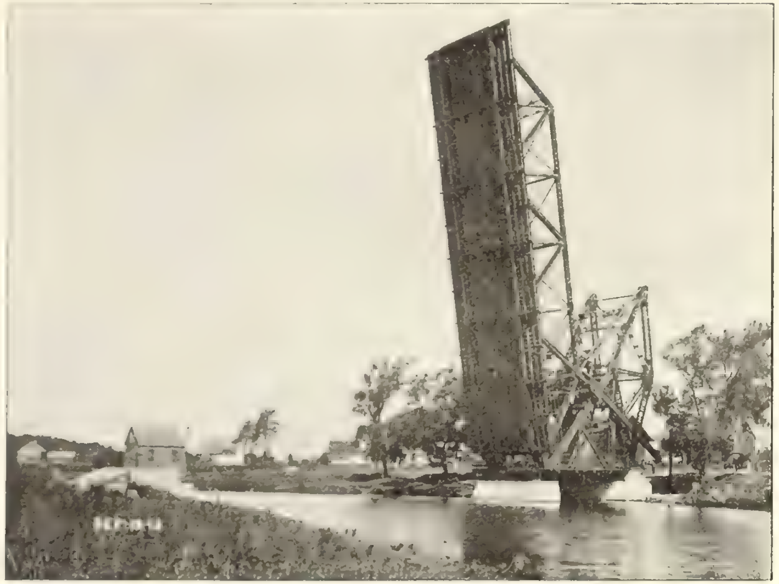
"Furnishing adequate quantities of water for carrying on the work is a serious problem, and in many instances we have been compelled to pump long distances. Two or three inch pipe lines are laid to the nearest source of supply, and the water pumped to the job by gasoline engines. In building out of Romulus this fall water was pumped from the Huron River, five miles away. On Grand River Road it was pumped six miles from the River Rouge. Long hauls over bad roads and scarcity of water are big factors in increasing our costs.

"After the preparation of the subgrade, which is flat, 2 x 6 inch side rails either of metal or wood protected at the top by a two-inch angle iron, are staked to the line of the grade along each side of the road. As the forms are subsequently used to support the templet and bridge from which the finishers work, care is exercised to get them rigid. We use a concrete mixer that travels under its own power, and from which a twenty-foot boom projects capable of being swung in the arc of a semi-circle. The dumping bucket is carried out on this boom under power which saves much handling. To prevent absorption of water from the concrete, the subgrade is thoroughly wet down. After receiving twelve complete revolutions in the mixer the concrete is dumped in place on the natural subsoil, no cinders, sand or other materials being used on the grade. The bucket is dumped carefully to avoid separation of the aggregate, and to make as little shovelling as possible necessary to roughly level the concrete for the work of the templet. We use a 2:3:6 mix, that is two cubic feet of cement, three cubic feet of sand, and six cubic feet of pebbles. The mix is wet, and of such consistency that men working in the concrete sink four or five inches. Clean material is an absolute

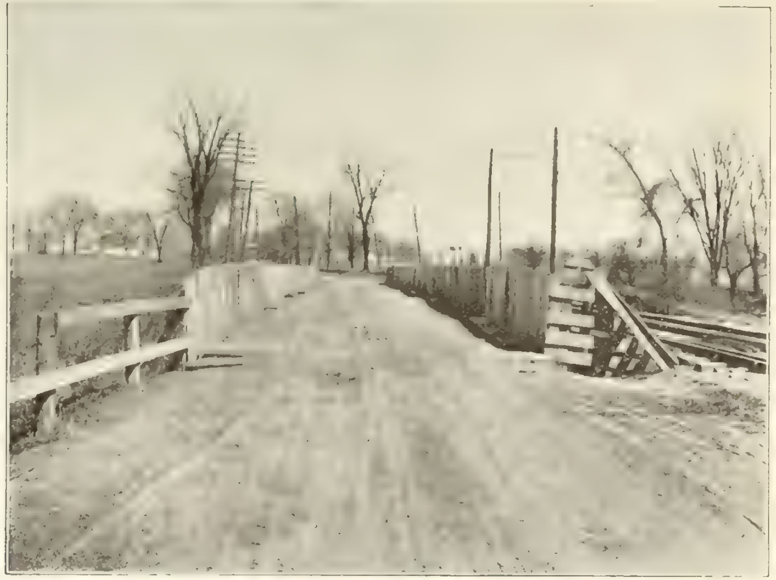
ROAD WORK IN WAYNE COUNTY



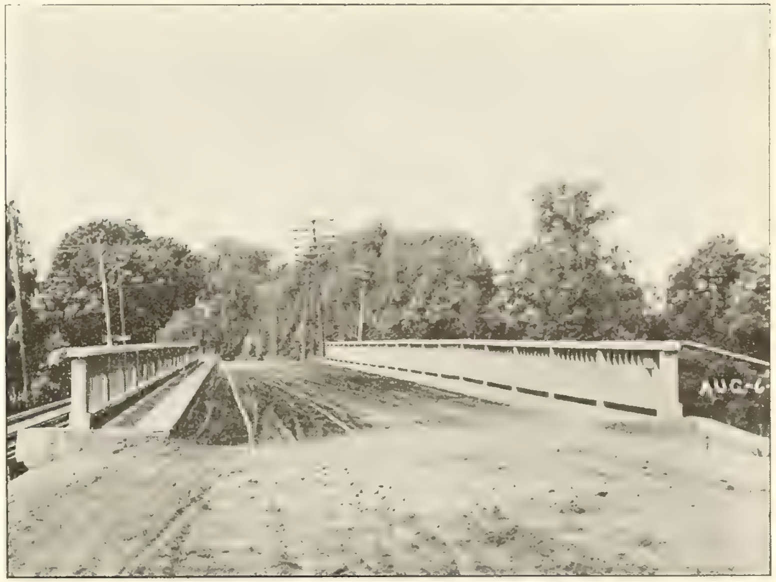
Bascule bridge over River Rouge—Closed.



Bascule bridge over River Rouge—Open.



Wayne County highway before improvement.



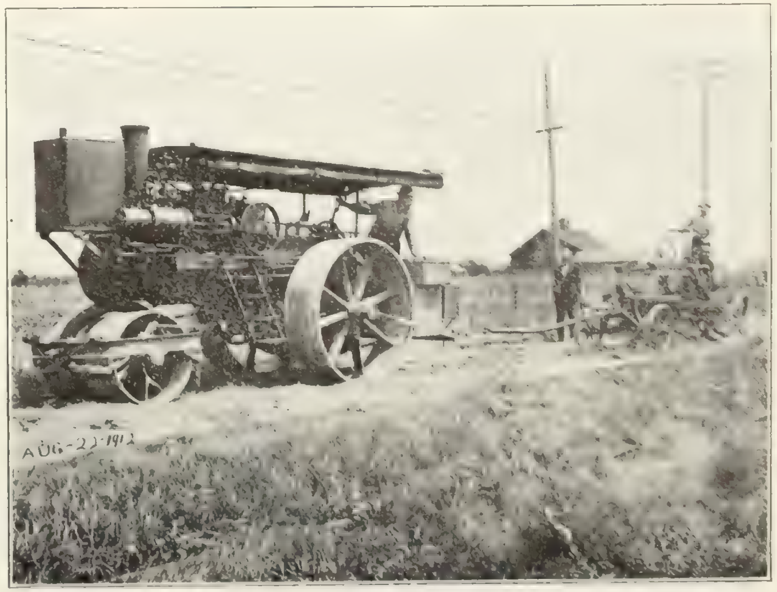
Wayne County highway after improvement.

ROAD WORK IN WAYNE COUNTY

Old tumbledown bridge over Rouge River near Dearborn.

Tearing up an old macadam road and preparing grade for concreting. Machinery used to cut down the cost.

This illustration shows what has replaced the above structure.



Grading behind an engine. An economical plan.

requisite to securing good concrete. Our pebbles are washed and screened so as to be free from loam, clay, and other foreign substances. They range from one-fourth to one and one-half inch and are so graded as to reduce the voids to a minimum. Our sand is bank sand, washed and screened, free from loam, clay, etc., and ranges in size from one-fourth inch to dust with the coarser articles predominating. Wayne County has no stone hard enough for our purposes, and all stone and sand used are shipped from outside points.

"The concrete is brought to grade and shape by the use of a templet. This templet or strike board is made of two-inch plank, preferably in a single piece, the curvature of the under edge being made to exactly conform to the finished surface of the concrete road which is crowned one-fourth of an inch to the foot. On each side of each end is an iron handle for drawing the strike back and forth. The curved edge is shod with one inch angle irons bent to the curvature of the strike, giving it a metal wearing surface. The length of the strike exceeds the width of road metal by one foot. A twelve inch plank is suitable for widths of road metal up to 18 feet. If the road is wider than this, a built up form of strike is necessary, which is trussed to prevent a sag or flattening of the crown. The strikeboard is sawed back and forth on the side rails, and moved slightly forward at each stroke, giving the concrete its initial shape. After this operation no workman is permitted to disturb the concrete in any way either by stepping in it or by throwing anything upon it. This rule is imperative, as a violation of it means a road with waves and depressions by causing the neat cement and finer particles to rise to the top. We aim to have the stone take the wear as it is the hardest part of the aggregate.

"The final finishing up of the road is done by two men whom we term floaters, who work from a bridge which rests on the side rails, having no actual contact with the concrete. A wooden trowel of home manufacture is used for this purpose. The use of a trowel of this nature prevents the road from becoming slippery.

"Joints are placed every 25 feet using a metal plate three-sixteenths of an inch thick and 3 inches wide. These metal plates are intended to protect the edges from spalling and chipping. They are curved to conform to the crown of the road. These thicknesses of asphalted felt (about 1/4 of an inch) are inserted between these metal plates cutting the entire depth of the concrete. These plates are provided with shear members which tie them securely to the concrete. We exercise a great deal of care to get these joints flush with the road surface as an unpleasant jolt is experienced by a fast moving vehicle in passing if they are too high or too low. Our whole aim is to provide a level, even surface, and the roads we are building at the present time show a vast improvement on this score over those built three or four years ago.

"When the concrete will stand of its own weight, the side rails are removed, and a three inch bevel is made at about 45 degrees by cutting off the edge with a shovel, and allowing the surplus thus cut off to fall to the side. This prevents a sharp division line between the concrete and the shoulders. Each day's work is finished up to an expansion joint, and no more than twenty minutes is permitted to elapse between batches during the day. The day following the laying of the concrete it is covered with a couple of inches of sand or loose soil such as is available, and is sprinkled during the day for eight continuous days. This prevents the road from drying out and is an important factor in properly curing the concrete so that it will attain its maximum hardness and strength. Plenty of water is vitally essential in producing good concrete.

"Roads are not opened for traffic until from two to five weeks have elapsed after the last batch of concrete is laid; the length of time depends upon the season of the year as concrete sets up much more slowly in cold weather than when it is hot and dry.

"Shoulders of crushed stone or gravel, whichever is the more available, are built three to seven inches thick and three feet wide on each side of the concrete; on many roads additional width of earth shoulders are built. This work is not started until after the road is at least three weeks old.

"All of our work is specialized, one crew doing the grading, another building culverts, another digging ditches, and making shoulders, another unloading and hauling and another at road building proper. These various operations are usually carried on simultaneously at various points along a given road. Machinery is used wherever possible since man and horse labor are scarce and expensive in the country districts during the roadbuilding season. Many labor saving devices have been worked out which increase both the quantity and quality of our work, and a personal inspection of our crews in operation is an interesting and instructive sight.

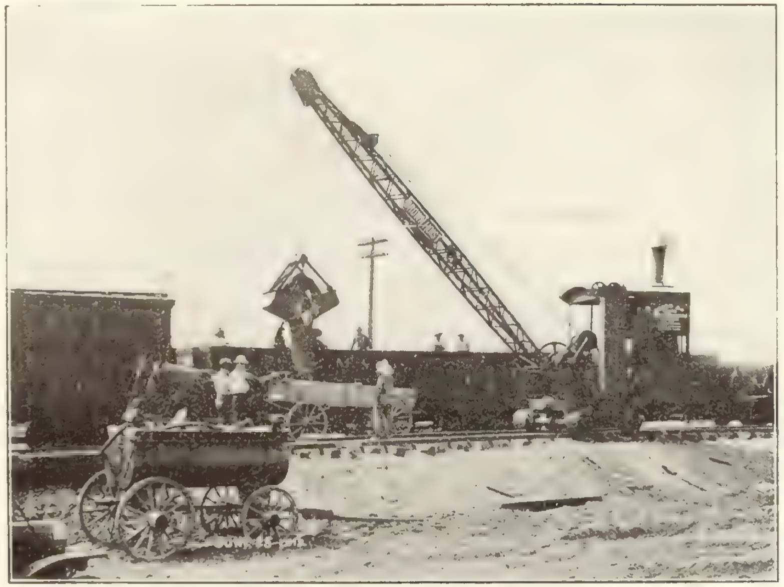
"We have had numerous people question our judgment on the width of metal adopted on various roads, but when we find on the greater proportion of the roads, grass and weeds growing luxuriantly on the gravel and macadam shoulders up to the very edge of the concrete, we feel we are justified in the policy we have adopted. No road is built less than 23 feet in width over all of material upon which traffic can turn out at any season of the year. The accompanying pictures will give a general idea of our methods.

"There are two factors to consider in highway construction: cost and efficiency. Cost is one of the main considerations of the taxpayer. The moment a road is contemplated, his first inquiry is, "How much will it cost?" The second consideration seems to us to be equally vital, "How good will it be?" This question of efficiency is often overlooked entirely.

"Cost must include not only first cost, but maintenance. The prevailing opinion seems to be that once built a road is for all time finished. This is a fallacy; no road is ever completed, because it is at all times subject to the breaking down processes of traffic, freezing and thawing; erosion by heavy storms, and the destructive chemical action tending to reduce everything in nature to its simplest elements. Care and maintenance of a road must be started the day the construction is finished, and must be continued for all time. This becomes a fixed charge, which unless the first construction of the road is of such a character as will suitably withstand the traffic it is called upon to carry, will increase yearly until it becomes an annual burden amounting to a large percentage of the original cost.

"We believe that if it is worth while to spend millions in Wayne County for good roads, it is abject folly not to protect that investment against absolute loss. To permit a road to go to pieces defeats the very object for which it was constructed. There is no special dispensation of Providence for the protection of a road, and unless continuously maintained, the

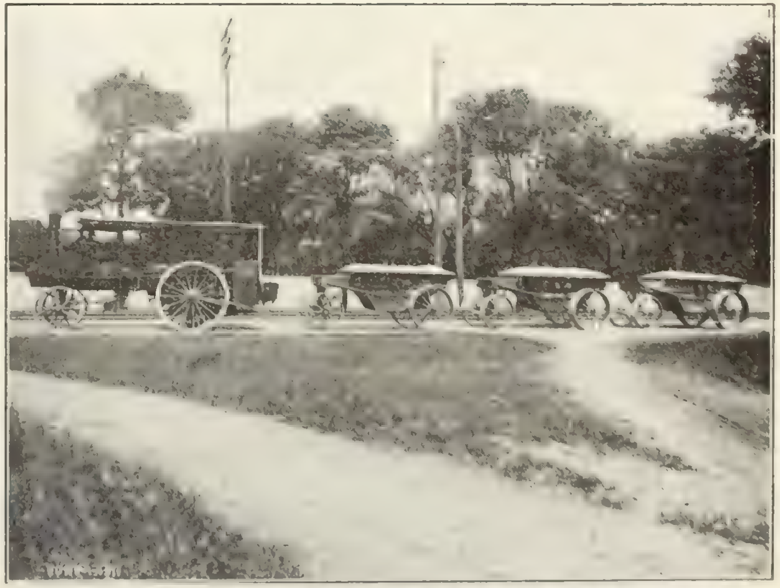
ROAD WORK IN WAYNE COUNTY



Unloading stone with a steam hoist—A practical labor-saving device for loading in wagons or a stock pile.

All ready for placing concrete.

Unloading from cars and stock pile. Road camp in background.

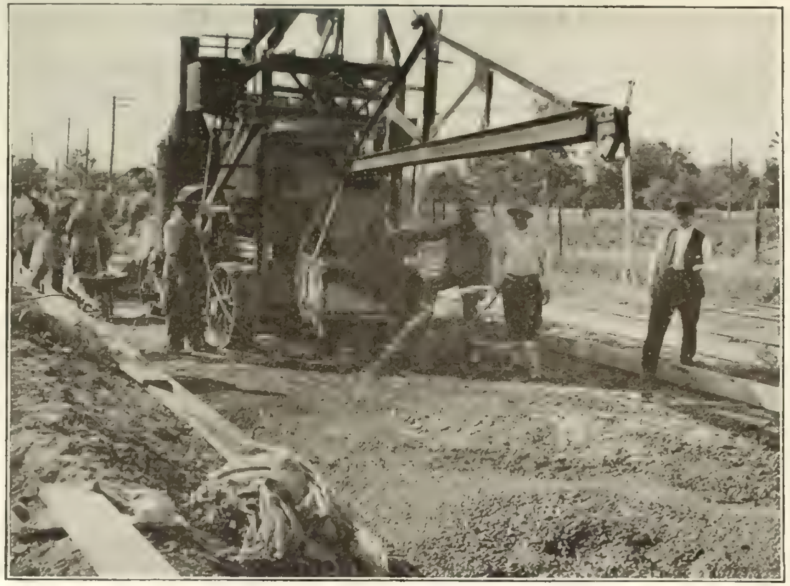


Hauling by steam. Each wagon contains seven tons of stone or sand. These outfits are used in combination with team hauling.

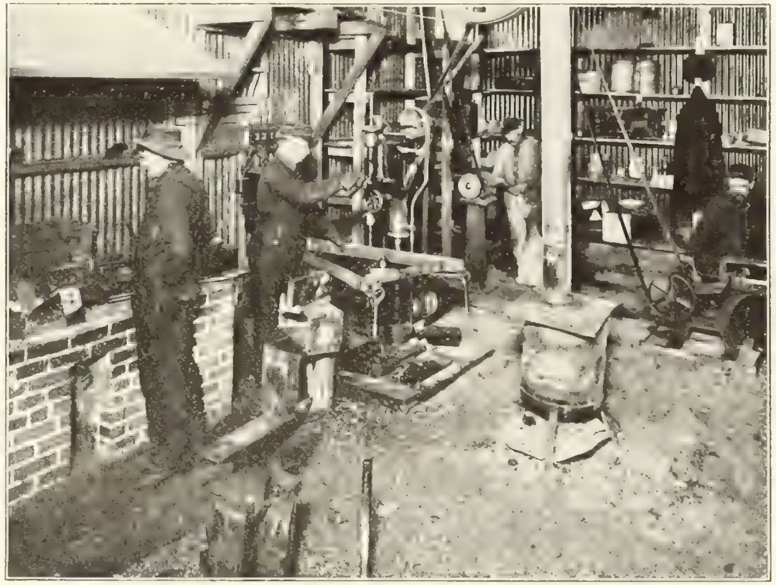
ROAD WORK IN WAYNE COUNTY

How the mixed material is placed on the road.

Setting up protection plates and expansion joints.

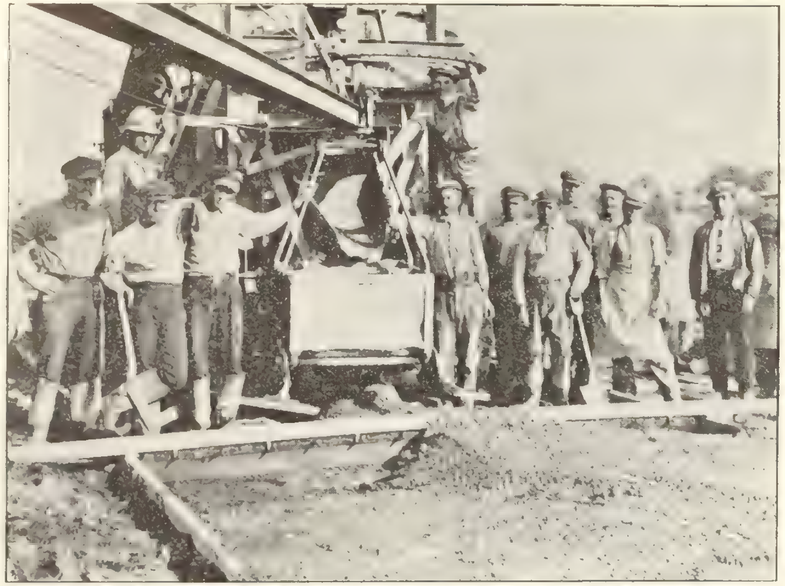


Sprinkling subgrade preparatory to placing concrete.



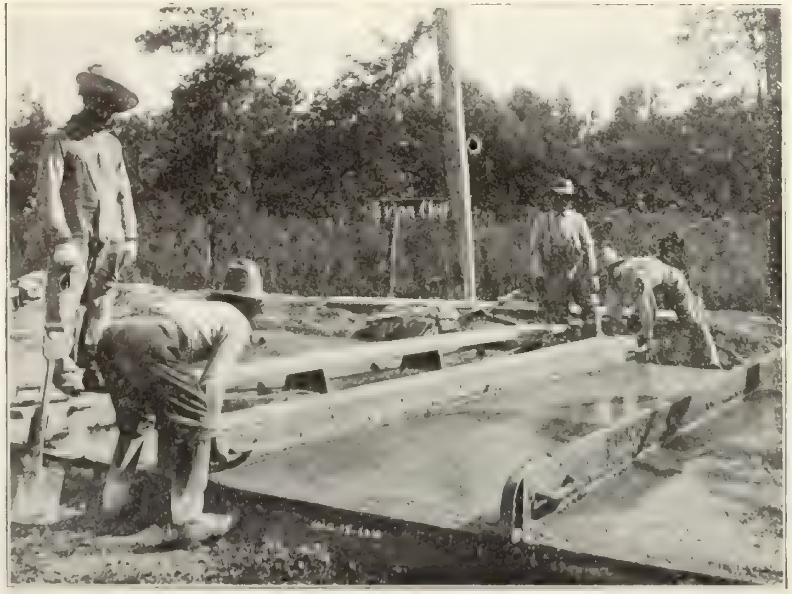
Machine shop where appliances are put in first-class working condition for the next season's road-making.

ROAD WORK IN WAYNE COUNTY



Expansion joint and metal protection plate in position in road.

Putting on the finishing touches with wooden floats.



Method of "striking off" concrete to give it a proper crown.

Finished road sprinkled continuously for 8 days How to cover road to "cure" it by retaining moisture in concrete.

building of all highways will be a fruitless undertaking.

"The efficiency of a road is dependent upon:

1. Economy of tonnage haul per mile. A greater load can be moved in less time on a concrete road than on a macadam or similar type.
2. Adaptability to commercial and pleasure traffic. The road must be built to sustain heavy trucks, high power autos, auto trucks and horse driven vehicles, and minimize the dust nuisance.
3. General condition for traffic throughout the year. The road that requires least repairs is in best condition for traffic at all times.
4. Degree of safety to travel. The road should be free from ruts and chuck holes, and the surface of such a character that it is not at any time slippery.
5. The probable increase of traffic due to improvement.

"Needless to say no type of road is a panacea for all road ills, but we believe that in the concrete road as developed and built by our crews under our supervision and guidance, we come more nearly obtaining a road that combines the highest economy and efficiency based on the board principle of ultimate cost than is obtained in other types of construction. A comparison of our maintenance costs with those of other localities where roads are maintained in good usable condition, and where $1,000 per mile and upwards per year is being spent on maintenance, will prove illuminating. A special feature of the concrete road as being constructed in Wayne County is its uniformity of wearing surface, a surface that does not give way in any one spot, while it withstands traffic generally over its surface fairly well. This is made possible by a careful selection of material, by our methods of measuring the aggregate, and care in finishing and curing so that uniform wearing surface is obtained, and is a big factor in eliminating maintenance costs."

Oiling State roads in Maryland is accomplished by the state Good Roads Commission with a 40- h.p. auto truck of the worm gear type carrying a tank holding oil sufficient for one mile of road, spreading at the rate of ½ gal. per yard.

The Grunwald Hotel, Calgary, has just been completed at a cost of $200,000. Something of a record in rapid construction was made on this building, it having been completed in less than four months from the time the steel was first started. The contractors were Messrs. McDougall & Forster.

Port Arthur is installing a new waterworks system complete, comprising a duplicate pipe line each of welded steel pipe of 24 inches diameter. This pipe line will be about five miles long, totalling ten miles of pipe, all subjected to a test of 500 lbs. to the square inch. Messrs. Drummond, McCall, of Montreal, are the contractors for the delivery of this pipe and special parts. An up-to-date pumping station is being erected at the shore end of the intake and will be completed by the summer of 1914.

Canadian canal traffic in the season now closing has broken all records. From the opening of the canals the increase in the volume has been steadily sustained. Up to November 1st a total of 46,428,283 tons were handled, this being an increase of 4,845,171 over the corresponding period last year. Of the total increase, the Soo canal contributed 3,384,713 tons; the Welland, 729,477 tons, and the St. Lawrence, 831,369 tons. The difference between the Soo and Welland figures indicates a large volume of Canadian traffic finding an outlet by way of United States ports.

Pile-Driving with Dynamite

A NEW type of concrete pile, which would seem to have little merit except the novel way in which it is planted by explosive force, has been put on the market by the Siegwart Company, of Lucerne, Switzerland, says the Engineering News. The new pile utilizes the bulged bottom principle common to several patented piles, but is novel in that the enlarged base is formed by the use of explosives. The process of making the pile is described as follows:

An iron tube containing a wooden pile with an iron point and a device at the upper end for deadening the blows of the pile driver is driven into the ground. The wooden pile is then removed and the cartridge provided with an electrical detonator is fixed in position at the bottom of the hole, and the tube is filled with wet concrete, a little above the level of the surface of the ground outside the tube. The iron tube is then drawn up some feet to prevent its end from being shattered by the force of explosion. After the detonation the concrete sinks downwards, filling up the space hollowed out by the explosion. Finally the tube is little by little filled with more concrete, and is drawn up gradually at the same rate as the concrete is filled into it.

After the completion of this process, and after sufficient time has been allowed for the hardening of the concrete, there is in position in the ground a pile with a base of greater lateral diameter than it is possible to produce by any other means. Moreover, on account of the action of the gas formed by explosion, these piles will give the best possible results in compressing the earth. In fact, one pile on this system serves the purpose of several piles on any other system, thus insuring a great economy. By using cartridges of greater or less strength the size of the excavation made by the gas is controlled at will; by the use of a cartridge 600 to 700 grams in weight there is, for instance, made a spherical hollow of three to four feet in diameter, according to the quality of the ground material.

Planer shavings and cement are used by the construction forces of the Southern Pacific Company as a plug in tremies for depositing concrete under water. As is well known, in using bottomless tremies in deep water the concrete in the first charge has to be deposited through the tremie full of water, thus defeating the purpose of the tremie, which is to avoid the separation of the concrete as it falls through the water. To get around this difficulty a number of schemes have been used, notably the use of a burlap plug or in extreme cases a flap bottom to the tremie. In the practice of the above named company, however, the tremie is first put down in the water and upon the top surface inside the tube is sprinkled a layer of planer shavings and cement. On top of this plug the concrete is deposited, pushing the plug ahead as the tube is filled, thus allowing the concrete to be placed in a comparatively dry tube. When the plug reaches the bottom the larger part of the stavings and cement goes out of the bottom and floats to the top.

Engineering Topics in the Old Land

London Correspondent of the Contract Record Deplores Misrepresentation of Canadian Conditions—The Part of the English Engineer in Canada—Advisability of Personal Investigation of the Field

London, Nov. 25, 1913

IT is somewhat difficult for the English mind to realise the resources of such a country as Canada, and it is more difficult still for it to realise that these marvellous resources remain—despite the progress that has marked recent years—practically untouched. To live in a "right little, tight little" island has its advantages, but one's outlook on the outside world is apt to become constricted, and even now insularity is a much too prevalent attribute of the home-dweller. The vision of the great mass of the population of Great Britain extends no further than the coast line, and as the sea may be reached in two or three hours from almost any part of the country the horizon is a limited one. That Canada has a great future before her none cares to deny, but that that future is imminent, is to a great extent present (if the expression may be used) and is already becoming history is beyond the grasp of the everyday individual one meets. The rapid growth of the population, the development of the cities, the expansion of agricultural and other industries (to quot the Contract Record) are beyond his ken, and Canada is to him a country of wooden houses, earth roads, single railway tracks and 160-acre farms, frost-bound and stagnant the greater part of the year and evoluting slowly towards civilization during the remainder. And it is particularly unfortunate that the over-glowing pictures penned and pencilled by the emigration agents have served largely to strengthen his attitude of ignorant apathy. This form of special (and specious) pleading is responsible for much, and the opinion has become pretty general of late that emigration is a hum and is run by a few interested parties for the sole purpose of overstocking the labour market and bringing down wages. The free farms are regarded as a delusion and a snare, and it is argued that settlers are trapped across the seas, at the instigation of the railway magnates, simply for the purpose of raising produce (mainly at a loss) for freightage purposes. The cheap cinemetagraph show must accept its share of the blame in the wholesale misrepresentation of Canadian life and conditions.

Cosmopolitanism in Engineering

Engineers, happily, form a more enlightened section of the community, their training being of a nature calculated to broaden their outlook. To say that they are in any way cosmopolitan—as are their German brethren—would be to misstate the facts. They do not read foreign articles for the simple reason that their knowledge of languages is confined to their own. They do not even appreciate the importance which, for instance, Spanish holds in the technical world, and hundreds of men yearly try their luck in South America without any preliminary acquaintance with at least the rudiments of that tongue which is a key to the country. Of course, when it comes to the English-speaking colonies, no difficulty of this sort presents itself, and yet there remains the feeling that American practice—as it is loosely termed—is not for Englishmen, and that while the colonial can learn from them, they have nothing to gain by rubbing shoulders with him. It would seem to escape their notice that, as regards Canada anyway, much of the engineering work has been carried out by Englishmen. Many of the schemes now in progress are in English hands, or at least owe their inception to the report of an English engineer. The point is, however, quite an unimportant one, and the broad fact to consider is that schemes of the greatest magnitude and interest are being carried out in all parts of Canada, and that these schemes deserve the careful study of the English engineer. He may derive considerable information from them, and their value is not in the least detracted from because local conditions differ from those obtaining "at home," and in differing require necessarily special forms of treatment.

Opportunities of Engineer, Manufacturer and Investor

In the west of Canada (the Contract Record is taken as authority for the statement) a great amount of engineering work is being carried out, while there is a demand for " new railways, improved roads, waterworks, sewerage, sewage disposal works, steel and reinforced concrete structures, bridges, gas works, electrical works, refuse incinerators" and much else. What an opportunity is here presented for the consultant and civil engineer, scratching painfully for a living on the seventh floor of a Westminster block of offices! Again, what opportunities for the manufacturer and the chemist in those parts of a country where, although there is an abundant supply of clay, "practically all sewer pipes, terra cotta, and other clay products are imported!" And yet, side by side with statements such as these, one reads that money is tight and that "difficulty is encountered" (and will, it is expected, be encountered for some time) "in obtaining large sums of money abroad." The English investor is well-known for the far-reaching nature of his investments, and (to quote a contemporary) "he cheerfully sends his money to the uttermost ends of China and Peru, but he is extremely apt to consider China and Peru as being situated less on the actual terrestrial than on Mercator's Projection in the atlas on the shelf in the study at home, and perhaps also in some mystic way, behind the mahogany counters of the palatial building in the city where his dividends come from. It is a pity that the investor does not travel more. In the absence of figures to refer to, one cannot say off-hand how many millions of British money are invested in Canada, but it is perfectly safe to say, however many millions are invested there would be added to them several millions more if English investors saw Canada for themselves to a greater extent than they do. In seeing Canada, they would not only see fresh opportunities for investments at every turn, but they would inevitably come back with a much greater sense of security in their investments." That the exercise of care in making investments is important goes without saying, and this especially when dealing in real estate. As Mr. G. T. Somers, late President of the Board of Trade of Toronto has said, no one should buy real estate in

Canada without first making inquiries from others than those interested in the sale; but this does not discount the fact that splendid investments other than those of "the assured sites of new cities" are to be obtained.

It would be useless to attempt a list of the big things going in Canada, and even if space permitted it would have no interest for the Canadian reader. The best advice that can be given the British investor—be he investing his brains or his capital—is to go and see for himself. Business and pleasure could be combined on a trip. Sir Richard McBride, the Premier of British Columbia, was right when he said that if a little more elasticity were displayed by business men in England in the way of playing up to the new conditions in Canada it would lead to a betterment of things all round. "Don't merely send us the things you make," he urged, "but send us what we need, and if you haven't got them make them." Such excellent advice applies equally to the engineer and the manufacturer, and coupled with the admonishment to "go and see" would work wonders. Nothing can beat knowledge acquired at first-hand.

Civic Apathy

According to Mr. Francis Neilson—President of the English League for the Taxation of Land Values—Edmonton, Alberta, is the freest city in the world, "allowing no private pockets to drain away the commercial values of her franchises," and the recent account by the Mayor of Edmonton of this single-tax and municipally-owned city has raised no little interest here. Municipal ownership finds many adherents in England, and its ramifications are extending yearly, but the bulk of the population takes not the remotest interest in municipal matters. Even opposition to enterprise is apathetic, and the daily press reveals in this as in other matters its splendid aptitude for chronicling nothing but items of quite ephemeral importance. The fact that a certain city has paid £100,000 "in relief of rates" from its profits on, say, the gas undertaking is blue-pencilled to make room for a paragraph concerning the knock-out in the seventh round of some third-rate boxer. The doings of such a civic dignitary as the Lord Mayor of London are carefully followed by the Press, it is true, but a remarkable exception was made only a day or two ago. On the occasion in question he honoured with his presence, a conversazione given by the Institution of Municipal Engineers, staying the evening through and speaking at length upon the work of the municipal engineer and the splendid record of the Institution. It is scarcely conceivable that the Press cut out the news paragraph that was sent to them, although, had the Lord Mayor attended a presentation of prizes to the Boy Scouts, columns would have been given up freely to a record of the fact. The civic spirit may be regarded in the main as dead in England, and eyes of envy are not unnaturally turned by the minority to a record such as that held by the city of Edmonton. Happily the apathy of the majority falls an easy prey to the energy and persistence of the enthusiastic few, and each year becomes more definitely progressive. A little of that spirit of enterprise which has been let loose in Edmonton, with such marvellous results, is badly wanted in the old country.

Kindness and co-operation between employer and employee is undoubtedly the best policy, but in this, as in the case of honesty, the man who does it merely for the sake of policy, doesn't get half the good out of the effort that he should.

Dominion of Canada Ore Dressing and Metallurgical Labratory

The Ore Dressing and Metallurgical Laboratory, which has recently been established at Ottawa by the Mines Branch of the Department of Mines, is now in operation. Experiments for the purpose of determining the best methods of concentration are being conducted on large samples of magnetic iron ore from the Ground Hog mine, which is situated on the Algoma Central Railway.

This testing station has been organized by Dr. Haanel, the Director of the Mines Branch, to aid in solving the problems of ore dressing of the Canadian ores. No charges are made for the investigations, which include the sampling and necessary assays, but the following conditions are imposed:—

(a) Samples must be bagged and delivered to the plant free of all transportation and unloading charges.

(b) For small scale tests, not less than 200 pounds will be accepted, and for large scale tests, not less than five tons.

(c) All testing products are to become the property of the Mines Branch, unless otherwise arranged before commencement of tests.

(d) Reports of tests will be incorporated in the publications of the Mines Branch, but single copies will be given to owners of samples when their tests are completed.

Under ordinary conditions tests will be made by the Mines Branch officials, but arrangements may be made whereby engineers or other competent persons may supervise their own experiments.

The following lists of full scale and laboratory size apparatus will convey some idea of the magnitude and latitude of the plant:

STANDARD SIZE MACHINERY

Crushing and Screening

One Hadfield and Jenks 12 in. x 8 in. Blake crusher; one Allis-Chalmers 24 in. x 14 in. "Style C" rolls; one Hardinge 4 ft. 6 in. conical ball mill; one Ferraris 6 ft. screen for coarse sizing; one Keedy ore sizer, No. 3, for fine sizing; one Duplex Callow screen.

Sampling, Recording, Etc.

Sampling is provided for by two Standard Vezin machines, placed in favourable position to cut out preliminary samples of coarse materials. The fine material is sampled by an eight unit system of the Flood automatic samplers.

Provision has also been made for hand sampling by means of the Jones riffled samplers.

All water lines serving standard apparatus are equipped with Keystone water meters, to enable the keeping of accurate records of water consumption.

Amalgamation and Concentration

One Allis-Chalmers 5-stamp battery, with 1,250 pound stamps, equipped with a 10-ft. tilting amalgamating table, followed by a Pierce amalgamator. The mortar of this mill may be, if so desired, arranged for inside amalgamation.

Six Callow tanks, 8 ft. diam., for de-sliming and settling; two Richards pulsator classifiers, launder type; one Overstrom sand table; one Deister slime table; one Richards pulsator two-compartment jig; one tandem unit Grondal magnetic separator, for wet separation of strongly magnetic minerals; one Grondal magnetic cobber, with dust collector for dry separation of strongly magnetic minerals; one Ullrich four-pole magnetic separator, for either dry or wet separation of weakly magnetic minerals; one Huff electrostatic unit, comprising a standard generator and two laboratory size separators.

Small Scale Apparatus

One Sturtevant 2 in. x 6 in. laboratory crusher; one Sturtevant 8 in. x 5 in. laboratory rolls; one Sturtevant 12 in. x 24 in. laboratory screen; one Braun planitary pulverizer; one Abbe six jar pebble mill; one gyratory screen (Hoover type), for making dry screen analyses with nested screens; one Richards combined laboratory pulsator jig and classifier, with glass side; one Grondal laboratory magnetic separator, for either dry or wet separation of strongly magnetic minerals; one Wilfley table, 24 in., laboratory size; one laboratory cyanide plant of 200 pounds capacity, consisting of a Parrel agitator and air pump, with the necessary solution, zinc, and sump tanks; two laboratory filter presses; one complete set of I. M. M. standard screens; one complete set of Tyler standard screens, after the Rittinger scale.

An experimental roasting and sintering plant, and also floatation apparatus will be installed during the coming spring.

Preparations are under way for the establishment of a Ceramic Testing Laboratory by the Mines Branch, which will be equipped with a full set of modern apparatus for the testing, under working conditions, of clays, feldspars and other materials used in the ceramic arts.

Frost Damage to Montreal Filters

Concrete Piers, Floors, and Ground Arches, Unprotected During Winter, Crack and Spall—Repair Methods and Report by Board of Experts

By Frederick E. Field*

AT the end of the summer season for outside construction contractors and engineers should give serious consideration to the proper protection of uncompleted work against frost action during the winter. Neglect in so doing is too frequently followed by serious damage, necessitating delay and costly repairs. During the winter of 1912 the filtration works under construction for the city of Montreal suffered considerable damage. Frost action on the partially completed structures produced many unusual results, which form the main theme of this article, which is an abstract of an interesting feature of The Engineering Record for November 22.

Contracts

The above work is divided into several contracts. Under contract 1 will be furnished the pumping machinery, blower, cranes and other equipment necessary for a complete installation, all of which will be located in a building adjoining the filtered-water reservoir. These pumping units are required to lift the water from the supply conduit to the prefilters, from which it will flow by gravity through the final filters and filtered-water reservoir to the municipal pumping station.

Contract 2 comprises the final filters and appurtenances, which will later be described in detail, as it was upon this contract that the damage by frost occurred.

Contract 3 includes sixteen prefilters, each with a normal capacity of 3,250,000 imp. gals., a filtered-water reservoir with a capacity of 6,000,000 imp. gal., and various supply and discharge conduits.

Contract 4 will include the filtration pumping station, wash-water tower and the superstructures of the prefilter operating gallery and gate houses.

Final Filters and Appurtenances

There are sixteen final filters, each having a net filtering surface of 3/8 acre, arranged in batteries of eight on either side of an operating gallery. The normal capacity of the filters is 50,000,000 imp. gal. per day when operated at a rate of 10,000,000 gal. per acre per day. The equipment is complete, including lighting, heating, and ventilating systems and sand-cleaning machinery.

Some of the more important items included in the work are: Earthwork (excavation and embankment), 100,000 cu. yd.; concrete, 34,000 cu. yd.; steel reinforcement, 1,000,000 lb.; cast-iron pipe and specials, 112 tons; wash-water gutters, 16,300 lin. ft.; filter material (sand and gravel), 35,000 cu. yd.; washing machine track system, 33,700 lin. ft.

Features of Design

The filters are each 55 x 340 ft. in plan, to accom-

Table 1—Meteorological Data for Montreal

Temperature	Dec., 1912	Jan., 1913	Feb., 1913	Mar., 1913	Average	Dec.. (d)	Jan., (e)	Feb., (e)	Mar. (e)	Average
(a) Mean	24.38	22.68	11.81	28.76	21.91	19.03	12.68	14.88	25.18	17.94
(b) Maximum	31.05	31.72	20.70	36.18	29.90	25.81	20.92	22.85	32.13	25.40
(c) Minimum	16.87	14.62	3.96	21.07	14.10	12.02	4.73	6.93	17.81	10.40
Total in inches					Totals					Totals
Rainfall	1.83	2.56	0.02	4.54	8.95	1.30	0.87	0.78	1.50	4.45
Snowfall	14.10	22.50	22.40	19.00	78.00	24.90	29.74	25.37	21.40	101.41
Pecipitation	2.91	5.08	2.79	6.42	17.20	3.75	3.73	3.29	3.79	14.56

(a) Mean of bi-hourly readings taken from self-recording instruments; (b) and (c) averages of the maximum and minimum temperatures for each day of the month; (d) thirty-eight years' "mean" for and including this month of 1912; (e thirty-nine years' "mean" for and including this month of 1913.

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*Resident Engineer, Filteration Works, Montreal.

modate Blaisdell sand-washing machines, which will run from the gallery to the extreme end of the filters upon tracks carried by concrete beams between the filter piers. The filters, Fig. 1, are covered by groined arches, supported on piers spaced on 19-ft. centres. The floor is flat and so constructed that the pier and wall loads are carried on reinforced pier and wall bases, entirely independent of the regular unreinforced 5-in. floor.

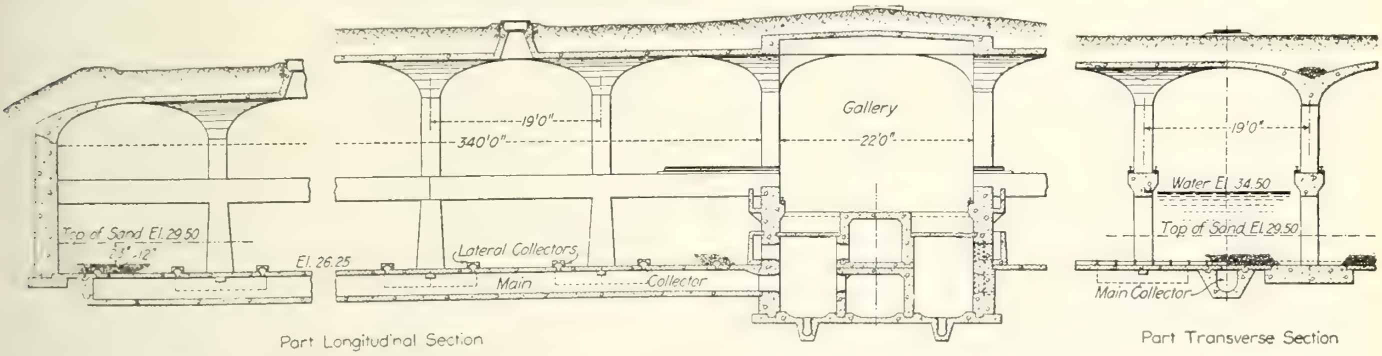
The main collectors run longitudinally the entire length of the filter and below the floor slabs.

In general the walls and wall bases are built in sections 57 ft. long, and the walls are built to their full height at one pouring. The track beams are built in alternate sections, each 38 ft. in length, with expansion joints on the centre line of every second pier.

The gallery is 454 ft. long and 22 ft. wide and contains the prefiltered and filtered water conduits and the necessary piping connections to the filters. The side walls carry tracks upon which a transfer table for conveying the washing machines from one filter to another will be operated.

Foundations

The entire foundation is a secondary deposit of material previously eroded by glacial action, and deposited by running water. The surface layer is yellow, while the underlying material is a grayish blue. An analysis of the soil shows that it consists of fragments of rock and rock powder graded from coarse to very fine particles, all of which under the microscope are found to be sharp and angular.



Part Longitudinal Section

Part Transverse Section

Longtitudinal and transverse sections through filters, showing beam runways for sand-washing machine.

Actual tests of the bearing power of the soil have shown that it will sustain loads of 3 to 5 tons per square foot, with only a slight compression of the soil even when saturated with water. In some of the tests the apparatus was surrounded by water to a depth of 8 ft. for two weeks without any appreciable settlement under the ram. As the maximum load to be carried by the soil does not exceed 2½ tons per square foot, these tests proved the soil to be entirely adequate for the loads to be imposed.

Work Completed Before Winter of 1912

The area covered by the sixteen final filters had been stripped of top soil, the entire area leveled off and brought to the subgrade of the filter floors, and embankment placed to a depth of from 4 to 6 ft. along the completed outside walls. In making the necessary fills to bring the ground up to the subgrade of the filter floors the best clayey material from the excavation of the filtered-water reservoir was used, all such material being placed in 4-in. layers and thoroughly rolled. There were only two comparatively small areas where there was any considerable depth of filling below the pier bases. One of these areas required a maximum fill of about 3 ft. and the other a fill of 4 ft. at the lowest point of the bowl-shaped depressions. Only 8 per cent. of the pier bases is on fills exceeding 6 in. in depth and more than 80 per cent. of the foundations is upon original ground.

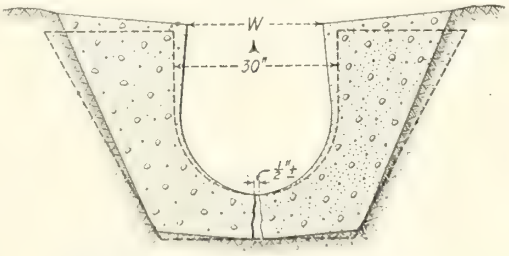
The main collectors and pier and wall bases were completed in all of the sixteen filters. Floor slabs were completed in eleven filters, no slabs having been placed in five filters on the north side of the gallery. All outside walls, practically all dividing walls, and all but a few track beams were competed on the south side of the gallery; but very little work of this character had been done on the north side.

The vaulting had been completed over a little more than two filters.

Protective Measures Neglected

All work was discontinued about the middle of November. The contractor did not make any provision for protecting the foundations from frost action, although he had been officially notified that serious damage might result if the work was not protected. The entire work could have been flooded with water to prevent the freezing of the ground below the foundations. This would have been an easy and cheap method of protection.

As an indication of the probable efficiency of such flooring it is instructive to note that the completed sections of concrete floor in the filtered water reservoir were in a depression which allowed surface drainage to collect to a depth of from 3 to 5 ft. which protected the work so well that there was no freezing of the ground below the floor and no resultant damage or lifting by frost.

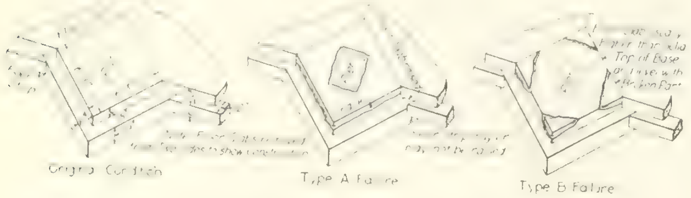


Type of collector failure. W was originally 30 inches.

Range of Temperature

The range of temperatures, together with the amount of rainfall and snowfall, is shown in the table of meteorological data. These statistics are based on reports from the McGill College observatory at Montreal. In comparison with the corresponding months of previous years the weather conditions were unusual in the following particulars: (1) The average temperature was higher by about 4 deg. (2) The total rainfall was in excess by about 100 per cent. (3) The total snowfall was less by about 22 per cent. There were no long continuous periods of low temperatures, and changes from low to moderate temperatures were frequent and sudden, which would tend to increase frost action.

Early in March, 1913, after the snow and ice had largely disappeared from the site, it was found that the disturbance by frost was general and much damage had occurred. The main collectors of floor slabs were raised and many of them badly cracked. The pier bases were raised and tipped and many were also "spalled" where adjacent floor slabs abutted. The wall bases were generally raised and some of them broken completely through by their unequal vertical movements. The track beams were raised and some of them were cracked from the varying movements of their supports. The dividing walls were raised and tipped and the expansion joints between sections were opened considerably more at the top than at the bottom of the walls. The roof groins were unequally raised along the outside barrel arches and some of them were displaced with respect to the adjacent sections of vaulting.



Type of failure of pier bases. Floor slabs removed from two sides.

As spring advanced and the frost left the ground further changes took place. The floor slabs settled and the widths of the cracks were reduced. The pier bases practically returned to their original position and the "spalling" along edges in contact with floor slabs became more general. The wall bases and walls also returned toward their original elevation, with a resultant closing of the cracks at expansion joints. The track beams followed the downward movement of the pier bases; some of the cracks closed and others developed as the result of unequal movement. The roof groins returned to place with some minor cracking at the springing line, and in some cases the upper piers were slightly tipped.

While the damage sustained by frost action was serious, the fact that this damage was no more extensive is not only conclusive proof of the relatively flexibility of the various structures but also that the work, as designed, was able to suffer great punishment without complete failure. It is interesting to note that the lifting of the foundations by frost was less on those areas where filling had been done than where the footings were on original soil. This may be explained by the fact that the filling was of selected material, placed in thin layers and thoroughly rolled, with the result that it was more compact and contained less voids for the entrance of moisture than the original ground.

A detailed description of some of the damage follows:

Main Collectors.—The general type of failure is indicated in Fig. 2. The pressure of the freezing and expanding ground forced the side inward and produced a longitudinal crack throughout the length of the invert, and also raised the collector from its original elevation. The width of the collector was originally 30 in., but the sides were forced together until in some instances the width at the top was reduced to 23½ in.

All cracked main collectors have been replaced, while collectors lifted and not cracked in the invert are being repaired by forcing grout into the space below the collectors with sufficient pressure to fill all voids.

Floor Slabs.—The floor slabs, while lifted and frequently badly cracked by the frost, have not returned to their original positions to the same degree as the pier and wall bases. Inspection shows that in many instances the ground has settled to its original elevation, leaving the slabs partially unsupported and with a considerable space between the bottom of the slabs and the earth. Badly cracked slabs will be replaced and others may be repaired by forcing in grout under pressure to fill all voids and cracks.

Pier Bases.—The upward and return movements of the pier bases varied considerably in various parts of the work. Levels were taken on each of the four corners of the pier bases at frequent intervals to determine their movement. The figures in Table 2 show the recorded movement of the pier bases in Filter 16, which may be considered as typical.

It will be noted that the greater return movement took place between April 5 and April 30, during the time the frost most rapidly left the ground, and that on June 5 the pier bases had nearly resumed their original elevations.

Spalling of Pier Bases

Possibly the most peculiar result of frost action was the spalling of the pier bases. This spalling, or horizontal cracking of the pier base above the shoulder upon which the floor slabs rest, was typical of a large number of pier bases against which floor slabs had been placed. In some instances the floor slabs were not so tightly wedged against the pier bases and no spalling of the pier bases was caused by the different relative movements of floor slabs and pier bases.

It was found by investigation that the greater number of pier bases were thus spalled between April 5 and 30, which, as shown in Table 2, was the period during which the frost left the ground most rapidly and the greater movement of the pier bases occurred. There was also a similar spalling of some of the wall bases against which the floor slabs had been placed.

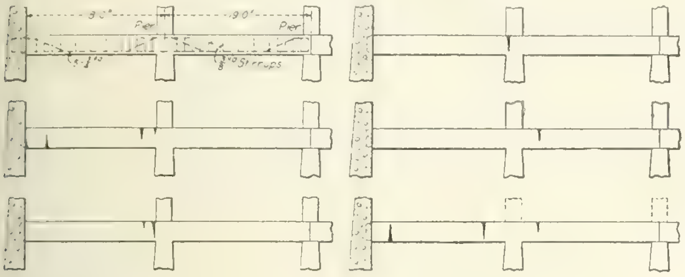
Table 2—Movement of Pier Bases, Filter 16

	Average elevation, feet	
Date	East Row	West Row
Summer, 1912	26.26	26.25
April 5, 1913	26.41	26.37
April 30, 1913	26.31	26.29
June 5, 1913	26.28	26.27

Track Beams.—The track beams opened at the expansion joints, as was to be expected, but the openings were not of equal width, the maximum openings being usually located at the expansion joints nearest the north and south walls of the filter. This was probably due to the fact that the outside walls were not appreciably, if at all, displaced by the frost. Their footings were somewhat protected and the raising of the adjacent piers would make the opening of the expansion joints more pronounced where one end of the beam was rigidly held than in the case of intermediate beams, where all the pier supports were lifted more or less uniformly. The cracks in the beams also occurred in those bays adjacent to the end walls, as indicated in Fig. 10.

In March cracks were seen on the top of the beams near the pier and in the bottom of the beam near the outside wall. Later as the frost went out of the ground and the pier bases settled these cracks closed so as to be almost invisible and other cracks developed in the tops of the beams near the rigid outside wall.

Roof Groins.—As in the case of the track beams, the greatest visible movement of the roof groins was adjacent to the outside walls. The outside wall and barrel arch remained stationary, while the lifting of the adjacent pier bases by the frost raised the upper piers and roof groins above the plane of the barrel arch, and in some cases above the adjacent roof groins. This displacement varied from a very small amount to 1½ in. When the frost left the ground the pier bases settled to their original position and the roof groins also went back to place, with some slight cracking of the arches near the springing line and a slight tipping of the upper piers, all of which became less apparent as the season advanced.



Location of cracks in beams which support runway tracks.

In several cases when the roof groin and adjacent barrel arch were built monolithic cracks developed approximately parallel to and not far distant from the crown of the arch, and these cracks also closed as warm weather approached. The movement of the roof groins is indicated in Fig. 5.

Controversy Over Damaged Work

In the spring of 1913, after it was apparent that the work had been seriously damaged, the contractor advised the city that he had investigated the work with a number of well-known engineers and that they had found "that the disturbance by frost is a minor matter compared with the subsidence of practically the entire outside walls and various parts of the structure where footing loads are appreciable. The subsidence of the walls would indicate that the structural design is inadequate for the bearing power of the soil, which, while having the general appearance of clay, is in reality a finely divided sand, stable enough when dry but unstable when wet, it being in fact a quicksand."

The work was also carefully examined by city and filtration engineers, who found that the soil was adequate for the loads to be imposed, that the design was in accordance with the best modern practice, and that the damage was wholly due to frost action, for which the contractor was responsible, as it was his specified duty to properly protect his work.

The city also appointed, Messrs. J. A. Jamieson, P. W. St. George and F. A. Barbour, who had not in any way been previously connected with the work, and instructed them to report on the adequacy of the soil and design, to determine the cause of the damage, and whether there had been any subsidence of the structures as claimed by the contractor.

The findings of this expert board of engineers are as follows: (1) That the action of frost on the soil under foundations has been the cause, directly or indirectly, of all damage which has occurred.

(2) That settlement has not been a factor in causing damage up to the present time.

(3) That the design has good precedent, is adequate, and, if properly carried out, the resulting structure will be well adapted to the intended purpose.

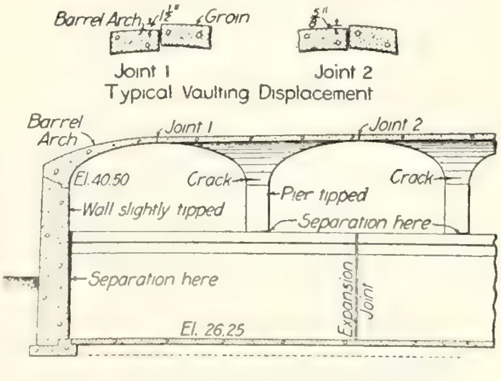
(4) That the soil has and will have under operating conditions sufficient bearing capacity to support the loads to be imposed, and that such minor settlements as will occur, either on soil in natural position or in filled areas, will be, as shown by the tests made, well within the limit to which the structure may be subjected, without detrimental effect.

(5) That the design and method of construction of the arches are in accordance with good practice, and the superstructure is of a type which does not require absolutely equalized foundation loads, this being indicated by the abuse which the superstructure has already withstood without serious final damage.

(6) That the walls, piers and structure which were raised have now practically returned to original position, and, except for some spalling of the masonry and the cracks in the division walls, will be, when the full load is on the roof, in practically as good condition as before the movement.

(7) That in addition to the replacement of the damaged collectors, which has already been undertaken by the contractor, the important work necessary to return the structures to a condition practically equivalent to that which would have obtained if no movement by frost had occurred, includes the replacement or repairs of lifted floors, slabs, and collectors, the repairs of cracks in the division walls, gallery floor and conduit, and the replacement of the retaining wall back of the gallery walls.

(8) That the repairing by forcing cement grout under pressure below structures which have been lifted from a good bearing on the soil should, preferably, not be undertaken until after the full load to be imposed by the filling over the roof is on the supporting members, but that such grouting of space between masonry and the underlying soil should be completed before water is admitted to the filter units for any purpose.



Examples of vaulting displacement.

(9) That since the raising of floors and collectors by frost has introduced abnormal conditions, it is essential that all vacant space be filled completely, or the lifted structures be replaced, and that the success of such filling of voids by grouting as may be attempted can only be proved by a test for leakage of the completed filter unit.

(10) That the fulfilment of such test of leakage

may be accepted as proof that no damage affecting the working capacity of the filters had resulted from the movements occasioned by frost during the past winter.

After the submission of this report the contractor acknowledged the damage to the work had been entirely caused by frost, agreed to repair all damage at his expense and had again resumed the work of construction.

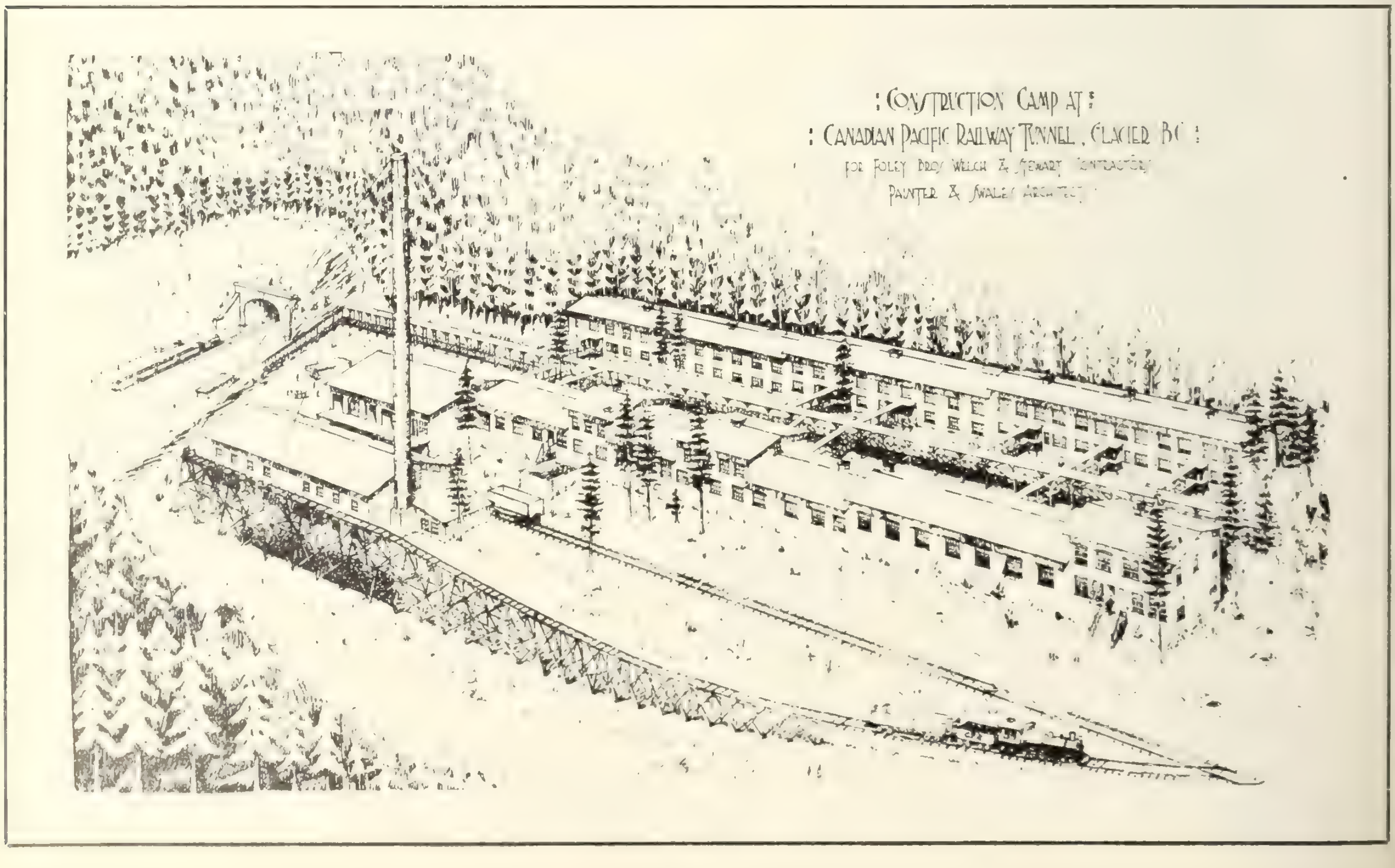
The filtration works form but a part of an extensive programme for the enlargement and improvement of the water supply for the city of Montreal, all of which is under the direction of Mr. George Janin, chief engineer of the city, and Mr. T. W. Lesage, engineer superintendent of waterworks. Hering & Fuller of New York, were the filtration engineers in charge of design. Mr. Norman M. McLeod is the contractor for contracts 2 and 3.

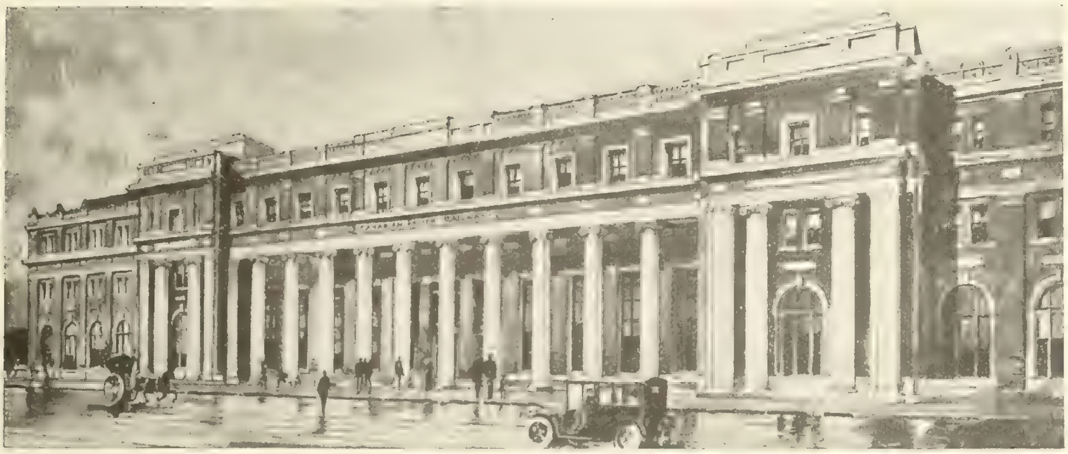
C. P. R. to Tunnel Mount NcDonald

THE Canadian Pacific Railway Company are now making preliminary arrangements for tunnelling Mount McDonald, the largest of the Selkirk range of mountains in the Canadian Rockies. The Selkirk tunnel will measure from east to west five miles through, with an approach of 1,700 feet on the west side and half a mile on the east. It will lower the pressure grade of the road 545 feet, the approaches on either side having a two per cent. grade, while the tunnel itself will have a one per cent. grade sloping west. By means of the scheme the distance will be decreased by nearly four miles, practically doing away with the danger arising from the snow-slides between Canby on the west and Bear Creek on the east.

Some idea of the magnitude of the undertaking may be gathered from the fact that over five hundred men will be given steady employment for nearly four years, and it will take over 20,000 yards of concrete to enclose the tunnel. There are at the present time on the preliminary work about 340 men, these being divided into three groups or camps. Camp 1 is the largest and is the scene of the main operations. another camp is located on the west side, and one at Bear Creek, some six miles east of Camp 1. Camp 1 has at the present time, and will continue to have throughout the construction of the tunnel, three steam shovels; there will be but one other shovel on the east side of the hill. The portal of the tunnel will be 150 feet wide by 40 feet deep, and it will be necessary to go down 50 feet further before reaching tunnel grade. Owing to the fact that somewhere in the neighborhood of 240,000 feet of gravel have yet to be removed before actual work on the tunnel can be commenced, the steam shovels will have plenty of work ahead. It will be necessary before getting at the main tunnel to change the course of the Illesillewaet River, for nearly a mile of its course, as this mountain stream rushes directly over where the big cut for the tunnel will come. The river will be taken some three hundred yards to the left of its present course, and gradually worked back to its original channel.

When the tunnel work is started there will be at Camp 1, seven buildings, including the permanent building of the Canadian Pacific engineers and such as will be located at the west end. The C. P. R. quarters will consist of four buildings, two residences, general offices and mess house. They will be located on


: CONSTRUCTION CAMP AT :
: CANADIAN PACIFIC RAILWAY TUNNEL, GLACIER B C :
FOR FOLEY BROS WELCH & STEWART CONTRACTORS
PAINTER & SWALES ARCHITECTS



Vancouver terminal station of the C.P.R. as it will appear upon completion.

the right-hand side of the tunnel, and will be directly over the present course of the Illecillewaet River. The business and living quarters of the contractors will include two immense buildings, a boiler house and an engine house capable of holding four locomotives at one time. The largest of these buildings given over entirely to the housing of the working force, with the exception of the office staff, will be 360 feet long by 50 feet wide, and of two storeys. Steam heat and hot water for washing purposes will be supplied from the boiler house, as well as electric power for lighting both buildings and tunnel. Shower baths for the men and 30 to 36 wash stands are to be located on both the first and second floors. The rooms will be each 12 by 12 feet with large windows swinging out, giving plenty of ventilation to each room.

Messrs. Foley, Welsh, and Stewart, who have charge of the undertaking, state that these heavier buildings are necessary owing to the enormous pressure of the snow in winter. All buildings will be built on stilts and will be raised about 12 feet above the ground, the reason for this being that the snow would block all the light, and in some cases bury the building. Walks are also to be raised from the tunnel directly into all buildings, as it will be practically impossible to keep a cleared track through the heavy snow.

What is probably the highest suspension bridge in the world has just been completed across the Bulkey River at Hagwilgate. The bridge is 600 feet in length and 250 feet above the river, its one span being 450 feet long. The structure is of a special stiffened type and is as rigid as it is possible to make it. The builders were George Cradock & Company, Wakefield, Eng.

That the west is far ahead of the east in the matter of road building and maintenance is the assertion of Mr. E. D. Gray, superintendent of the Kingsway road construction through the South Vancouver municipality. Passing through Toronto on a tour of inspection of the eastern provinces, Mr. Gray said that there was more paving being done in the west than in Ontario, and that the province needed re-vitalizing in road construction.

The C. P. R. Terminals at Vancouver

WORK is now proceeding on the terminal station of the C. P. R. at Vancouver. The eastern wing of the old building was torn down early in the year, and in March the erection of the steel frame for the new six-storied structure was commenced. It is being constructed of red brick, with terra cotta and limestone trimmings.

Work is being rushed day and night on this eastern section and by February 15, 1914, practically a third of the station will be completed. The office staffs and station facilities will then be transferred to the new station, and in the following month the buildings now occupied will be dismantled, and upon the site there will be erected the Granville Street Viaduct, another of the terminal scheme units.

From east to west along the track side, the new station measures 480 feet, practically two blocks. Along the Cordova Street side there are in course of erection ten great Corinthian free-standing columns and ten engaged columns, of limestone.

The big main entrance opens upon Cordova Street, exactly in the centre of the building. From this main street entrance straight through the general waiting room is the main entrance and exit to and from all trains, while from the Granville Street entrance on the west end of the building, by a wide sweep of corridor running the full length of the station, communication is given to the Plaza entrance on the east end. There is also another entrance on Cordova Street and one on the track side for third-class passengers from the wharves and trains, making six entrances in all.

A retaining wall is nearly completed for the purpose of supporting the tracks, which are being raised four feet above the present level. A railing to separate the passenger tracks from the yards and freight lines surmounts this wall, which is 1,200 feet long, and is constructed of reinforced concrete, as will also be several hundred piers for supporting platform shelters and bridges. A covered passenger bridge thirty feet wide leads from the main entrance on the track side, which will be fitted with large swinging doors, to the platforms below, while the stairs, leading down to the platforms, will be six feet wide, and will be biult from both sides of the passenger bridge.

There will be practically two floors below the street level on the track side of the new station. These will be devoted to the baggage and express departments, the lower floor being used mostly for heavy and bonded baggage. The mail room will also be on this floor, as will the telephone exchange, general service rooms, part of the dining car service department, boiler and pump rooms. The boiler room will contain three 150 horse power boilers, which will supply all heat to the station and wharves, using the hot water system of heating. Two large electric transformers will be installed on this floor for lighting the building and running the elevators, of which there will be ten, both freight and passenger.

On the lower mezzanine floor will be located the kitchen, auxiliary store-room, and baggage room. The advertising room of the general passenger agent and the baggage department's unclaimed bundle and valise baggage, will also be on this floor.

The central portion of the main floor is given over to the general waiting room, which will be 60 feet wide by 150 feet long, with massive circular columns at the sides, and the ceiling, which will be of heavy beam and panel effect, is to be 40 feet above the floor. All floors, with the exception of the offices, will be of granolithic, and the entire ground floor basing will be of marble. On the main floor will also be the restaurant and lunch room, railroad and steamship offices, women's waiting room, and smoking room. The ticket offices will consist of eight booths. A large lobby opens off from the general waiting room for first and second class passenger business, separate accommodations being supplied for third-class, third-class having separate waiting room entrance, etc.

The third-class waiting room and ticket office will be on the upper mezzanine floor, between the first and second floors. A stairway leads up to this waiting room from the third class entrance on the main floor. The general freight department, local treasurer's general offices, general passenger agent's, baggage agent's, claims agent's, and purchasing agent's general offices will be located here, as will also the Canadian Australasian Steamship Lines, the assistant passenger agents Trans-Pacific lines, and commissary. The public pay office of the paymaster is to be on the extreme eastern end of this floor, with a stairway leading up from the eastern or Plaza entrance.

Dominion Express, sleeping and dining car department, fuel department, solicitor's, and land department's general offices will be placed on the second floor, as will the ship-husband's offices and general staff.

The attic floor will be given over to railway telegraph, draughting room for the engineering department, and the superintendent's general and private offices. All office floors will be of hardwood.

The Canada Building, Saskatoon

In an article relating to the above building published on page 55 of The Contract Record for November 26 we omitted to record the fact that the architects were Messrs. Jas. Chisholm & Son, 310 Enderton Building, Winnipeg, to whom we were indebted for the particulars of design and construction and also for the illustrations.

Owing to the value of the clay deposits found near Strassburg, Sask., there is the probability of a brick-making plant being established there soon. An analysis was recently made of the clay deposits and it has been pronounced a fairly good brick clay, burning to light buff color, hard and fairly porous.

Steel Guyed Derricks for Building Erection

THE erection of the steel work of the 21-storey Commercial and Continental Bank Building, Chicago, was done by means of steel derricks of the guyed type, which the erectors considered preferable to stiff-leg derricks. The steel work can be erected about as rapidly with one type as with the other, but a guyed derrick can be moved up two floors and be ready for operation again within about two hours, while stiff-leg derricks require a considerably longer time to move and make ready for operation. With the latter also, the boom can work only through an angle of about 270 deg., while with the guyed derrick the boom can swing through the entire circle.

The building is 324 x 166 ft. in plan and about 260 ft. high above the street level. There were six steel guyed derricks. Two of these were of 30 tons capacity, with 90-ft. mast and 80-ft. boom. The other four were of 20 tons capacity, with 110-ft. mast and 100-ft. boom. They could erect the columns and framing for two floors before being raised. Each derrick had the mast supported by eight guys of 1⅛-in. steel cable attached to a cap pivoted on the top of the mast. These were anchored at first to 1⅛-in. looped cables embedded in the concrete foundation piers for the columns, but after the derricks were raised the guys were anchored to the steel columns.

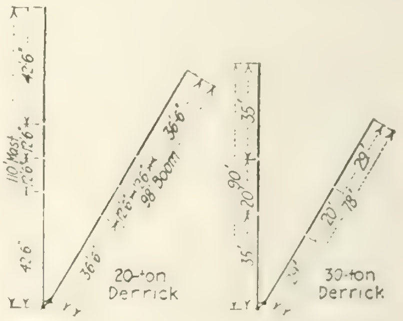


Diagram of 30-ton and 20-ton steel derricks for erecting buildings.

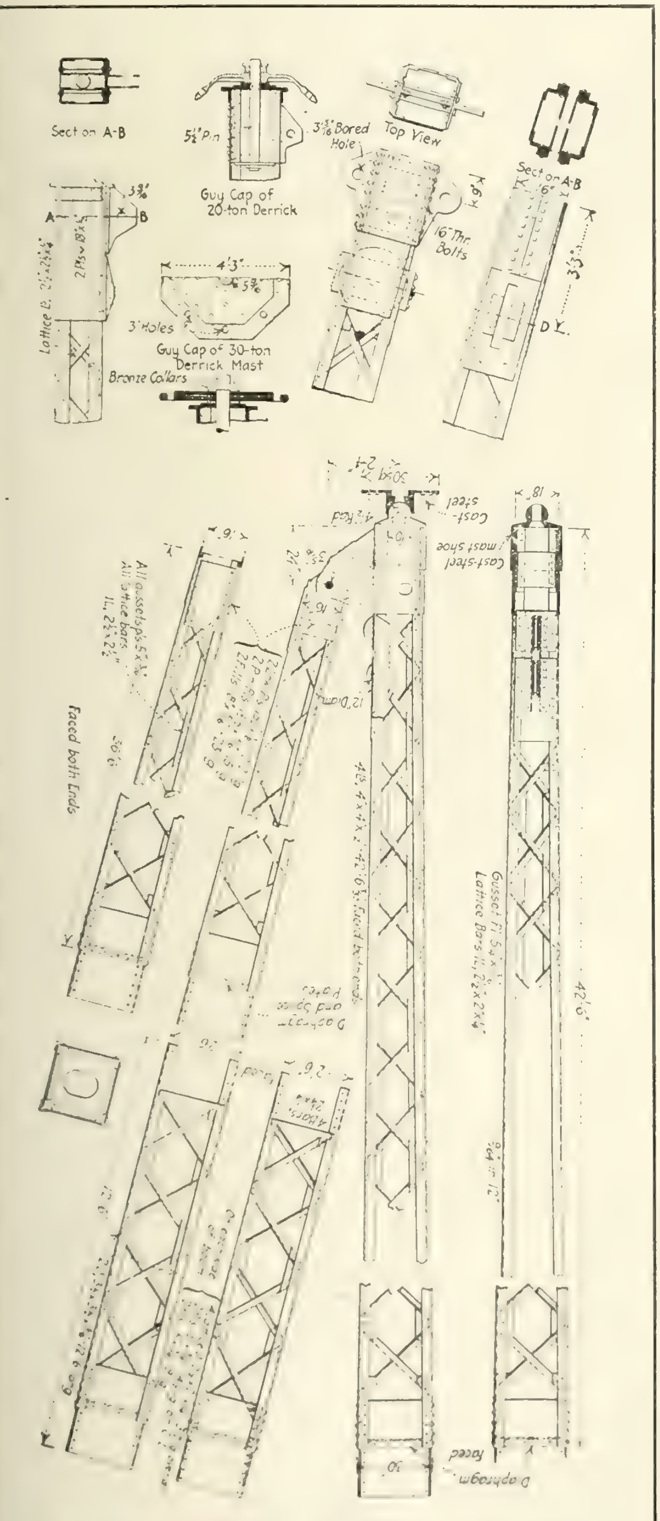
The hoist of each 30-ton derrick was operated by an electric motor of 100 h.p., while each of the lighter derricks had a 50 h.p. motor. The hoists were first located in the basement, but were later moved to the first floor for the benefit of the enginemen. Signals governing the movements were given by bell cords operated by a man at each derrick, the bell being located near the hoist operator. The hoisting and topping lines consisted of ⅝-in. wire cables, with four-part tackle for hoisting and three-part tackle for topping the boom. The derricks were swung by hand power, one or more men bearing against an 8-ft. horizontal pole connected to the lower part of the mast. The number of men depended upon the velocity of the wind, and in calm weather one man could swing the derrick easily.

Twenty-Ton Derricks

The maximum reach is 95 ft. from the mast, with a load of 20 tons at that distance, and the boom can be swung to a vertical position.

The mast and boom are box-lattice girders, built up of four angles, with lattice angles on all four sides. Both mast and boom are built in four sections; the two middle sections of each are 12 ft. 6 in. long and enable the length to be varied as required for different work or buildings. The sections are faced at the ends and are put together with bolts in the splice plates; they are stiffened by diaphragm plates at the splices.

The foot of the 110-ft. mast has cover plates on the four sides, with side plates forming the shoe for the boom, which is fitted to a 3½-inch pin, while above these side plates is a heavy plate with 6 x 3½-in. angles in which are journaled two 12-in. rope sheaves. The foot of the mast is stepped into a cast-steel shoe having a spherical bearing formed on the bottom, this bearing resting on a cast-steel base. The chord angles are 4 x 4 x ½ in., with lattice angles 2½ x 2 x ¼ in. riveted to the chord angles and to gussets or connection plates. The head of the mast is also fitted with plates, and has top plates riveted to flange angles. Through these top plates passes a 5½-in. pin 44 in. long, on which rides a cap 4 ft. in diameter, to which the guy cables are attached. The section of the mast is 18 x 18 in. at the shoe and the top, and 30 x 30 in. in the middle.



Details of derricks.

(Most of the details apply to the 20-ton derrick; some 30-ton details are included.)

The 100-ft. boom has four corner angles 3½ x 3½ x 5/16 in., with lacing angles 2½ x 2 x ¼ in., and is spliced in the same way as the mast. The bottom has cover plates on all sides, and pin plates for the 3½-in. shoe pin. The top also has cover plates. In cross-section the boom is 16 in. square at the bottom and top and 28 in. at the intermediate joints and in the removable portions. The top is fitted with a 20-in. sheave for the hoisting line and with lugs for attaching the topping lift and the swinging lines.

The parts are put together with ¾-in. rivets in 13/16-in. punched holes; while the splices have 13/16-in. holes for ¾-in. bolts. Contact surfaces were given a coat of linseed oil, and the work was given a coat of graphite paint when completed.

Thirty-Ton Derricks

These had 90-ft. mast and 80-ft. boom, with a working reach of 75 ft. and a hoisting capacity of 30 tons at that reach. They are of the same design as the 20-ton derricks, but with only one removable section in the mast and boom.

The mast has chord angles 6 x 6 x ⅝ in., with lattice angles 2½ x 2½ x ¼-in., and gussets of ¼-in. plate 5 in. wide. The spherical bearing on the cast-steel shoe rides in a bronze bushing in the base plate, and the head of the mast has an octagonal cap 51 in. diameter for eight 1⅛-in. guy cables. This rides between bronze collars on the 5½-in. pin. The boom has angles 3½ x 3½ x 7/16 in., with lattice angles and gussets the same as in the mast.

Slate Roofs

By a Slate Man

THE prime requisites of any sort of roofing material seem to lie within the following bounds: Architectural adornment, fireproofing qualities, permanence, non-porosity, and comparative low cost. The prospective builder is fairly bewildered by the multitude of various roofings on the market to-day, but when the matter is reduced to its prime factors, it would seem to me that the logical conclusion for the average builder should be slate.

Slate is the only roofing material to-day, excepting wood shingles, which is offered to the consumer unchanged, except in form from its natural state. It is a close grained, tough elastic stone, with a more or less perfect cleavage. It is produced in black, blue, red, green, purple, and variegated and varies in thickness from 3-16 of an inch to 1½ inches to suit the requirements imposed on it. The standard thickness is 3-16 of an inch, making a roof of this material weigh 650 pounds, as against 400 for shingles and 2,000 for tile.

The best slate, both as to texture, grain and lasting color, comes from old, deep quarries. "Top Slate"—that is, slate taken off close to the surface in new quarries, is apt to fade out and to become soft and unserviceable. Slate rock is taken from the ground in large blocks as all stone is quarried, and while fresh is split into sheets of uniform thickness, trimmed to the desired size and marketed without further preparation. It can readily be seen that in all cases where the householder wishes to use his rain water, a slate roof is the cleanest source of supply for his cistern.

Slate is possessed of a very peculiar natural characteristic—while it splits very easily with the grain and works, while newly quarried, almost as easily as wood, it is practically impervious to moisture, taking up less than one-fourth of one per cent. of its gross weight after a protracted immersion in water and an imperceptible amount on ordinary exposure to a heavy rain. The advantages of this characteristic are evident: there is no chance for the rotting of the supporting timbers by seepage or the disintegration of the material by action of the frost in the winter time. In addition to this, while slate is elastic it is unaffected by either heat or cold, having as a co-efficient of expansion .000005, it is evident that there can be no splitting of the individual slates by the strain at the nail holes caused by excessive heat and cold.

As a protection against fire, slate is without a peer—in fact, a very acceptable fire-place might be constructed of slate slabs. The activities of the various fire commissions of late years have produced figures to show that 60 per cent. of the fires of to-day are caused by exterior ignition.

As to architectural adornment, there is no gainsaying the fact that slate makes a handsome roof, easily adaptable to any style of architecture and by its durability retaining its ornamental qualities through a practically unlimited period. Slate split to greater thicknesses than the standard, is becoming universally competitive to the more expensive tile roofing, and approaches tile closely in both weight and cost. The added thickness, while of architectural value at times, does not in any way increase the actual roofing value of the material.

Gases of all kinds, chemical fumes and smoke have no effect upon slate; and it is a material largely in demand in places where various metal and ready roofing are unsuitable, such as chemical laboratories, large factories, and the construction of railroad buildings. In Europe, where slate has been used for centuries, there are a number of roofs which have been on for two or three hundred years, and one old chapel in England, built in the eighth century, has had the same slate roof on it for a thousand years, and it is still performing all the offices of an ideal roof.

The Protection and Upkeep of Road Equipment

By Daniel J. Hauer

No matter whether roads are built by contractors or by day labor forces under the direction of engineers, the item of plant and equipment is one of the prominent factors of cost. Inadequate plant means material increase in the cost of construction. Only recently the writer stood watching some road building upon which only a few tools were being used, and most of them were ill-adapted to the work. It was difficult to calculate accurately the exact amount of money that was wasted, due to a lack of road equipment, but it was easily estimated that the cost of construction was increased at least 25 per cent. Likewise, too much plant can make an added cost. Even with the proper plant, handled in an efficient manner, the plant item in road construction is a larger percentage of the total cost of the work than in most other classes of construction.

Naturally the life of any machine is dependent upon the use and care given it. The longer the life, the less the annual depreciation, consequently some of the high plant cost can be eliminated from road construction by proper care and upkeep of the equipment, and by selecting the most improved and economical types.

As far as possible the same machines should be used for many different purposes. This can be done in two ways: By trying out machines designed for one particular kind of work, for other kinds, and by adding attachments to machines that thus adapt them to three or four different things.

Keeping Plant Costs Down

To illustrate, a contractor once found by experimenting that a certain kind of road grader would spread crushed stone for macadam at a very much less cost than it could be done by any other known method, at that time. Then a road roller that can be used as a traction engine, with a scarifier attachment, and likewise for operating a stone crusher, or other machines, can be said to be four tools in one; not that it is possible to use it for more than one purpose at a time but in the present method of building roads a roller is used a small portion only of the time, so it is economical to adapt it to as many uses as possible. In this manner the cost of plant, or rather the investment in plant, can be maintained at the minimum.

In like manner, wagons, which are an important factor in road building, should be of the most improved type, and adapted as far as possible to all kinds of hauling. So too, with concrete mixers. Some contracts demand a hot mixer as well as one for mixing ordinary concrete. Money is saved when one mixer will answer for both purposes.

Another item in the cost of plant is in the character of the plant purchased. Cheap and poorly made plant means money lost to the contractor in several ways. Delays occur through breakdowns and these are always expensive. Cheaply made tools mean continual repairs and a short life, and are added expense to any job. Only well made tools should be used. A guarantee as to the construction of a machine can and does mean little. It does not mean payment for delays caused by breakdowns, nor for poor work being done. The ability of a manufacturer in swearing that his product is a good one is not a help to a contractor or engineer in getting his work done, nor in showing that the machine in question is well built. The greatest safety is in buying from a firm of recognized responsibility, one of integrity, and one that is so well advertised that it must stand behind its products by putting into them only the best of materials and workmanship. This is the best guarantee possible. This means work done at a low cost. A firm with such a reputation means that thousands of dollars have been spent by it and its customers in obtaining these results. The new customer profits from these past expenditures.

Road work is done in comparatively short stretches, usually in a single season, which varies in length from about 100 days, to 180 days, according to the climatic conditions. A contractor's plant is moved on to a job, and is used along the line of the work, part or all of the time during the season. Much of a contractor's plant is made up of transportation machinery, and even other items of plant are only working in one place for a few days at a time, so that to protect plant while at work on such jobs is very difficult, and in many cases any kind of a protection is a detriment, and a great hindrance to the free movement of the men and teams.

Giving Care to Equipment

All machinery should be protected when it is not being used, and some when it is in use. Boilers at work use much more fuel when not protected. Some kind of a house, built in sections, should always be used to protect boilers. Such sheds can have one side left out, and a canvas curtain used when necessary. If the sides and tops are built in sections they can be hooked together with hooks and rods and staples so as to be rigid enough to stand up against the wind and weather.

Machinery that cannot be protected while at work can be covered with canvas coverings over night, during rainy spells and at such times as they are not in use. Every traction engine and roller should be thus protected. Steam drills and such tools can be covered with a canvas jacket. The machinery part of a concrete mixer can be so protected, and also pumps and other equipment. Heavy water-proofed canvas will be found to be excellent for this purpose, and not only keep the machinery clean from dust and mud, but will likewise prolong the life of the equipment. As the canvas becomes worn from use, it must be re-treated with water-proofing liquids to preserve it.

At the end of the season, with the job finished, the question always arises: "What shall be done with the plant?" To move it from its present place to some central storage point, will mean an added expense to get it onto a new job. If the work on the same road is to be continued the next season the entire outfit may have to be moved back. The plant can be moved to the next job at the minimum cost from the site upon which it last worked. Then the question comes as to how repairs shall be made, and the protection to be given the plant from the winter weather.

Situated away from machine shops, proper overhauling cannot be given to all the plant, but it will be possible to replace many of the worn and broken parts with new ones, tighten up all loose keys and nuts, true up all bearings, and do all repairing that can be done in the open. Then all iron and wood work can be painted. This is a protection not only against the weather, prolonging the life of the plant, but is also a business proposition that pays well, as every one is impressed with machinery that looks well, and paint covers a multitude of defects.

In some localities it is possible to obtain an empty warehouse or barn in which the various machines can be stored while they are idle, or through the winter season. This keeps them entirely out of the weather, and also allows repairs to be made under cover, which means not only quicker, but also cheaper work.

For winter storage it is also possible to group a number of machines together, and build over and around them a temporary shelter made of cheap boards and single-ply tar paper, which will last a winter season. By using the tar paper, the boards can be spread 6 in. or more apart, both on the sides and roof. Around this temporary shed a ditch should be dug so as to prevent surface water from getting to the machines.

If it is not possible to protect the machines by any of these methods, then the canvas coverings can be resorted to, with fairly good results. These covers should, as far as possible, be shaped to the machine upon which they are to be used. Good and substantial brass eyelets should be fastened in the well bound edges, so that the coverings can be tied tightly to or under the machines, otherwise the wind will flap them loose, soon beating the covering into shreds, as a flag is worn out by the wind, and thus exposing the machine to the weather. Canvas coverings made to fit any machine will always be found useful in protecting machines over night or when not in use for a few days.

Whenever machines are not stored for the winter in buildings, they should be stripped of their brass and glass parts, otherwise these fixtures will be broken or stolen, which means a serious loss. The parts from each machine should be placed in a separate box, nailed up, and properly labelled, the box being stored away for safe keeping. If the machines are stored in a building, it is not necessary to take off parts, as if any one breaks into the building he must go to the trouble of taking off the brass, while if the parts are stored in boxes, the rascals take box and all, giving them much less trouble, and thus assisting them in making a clean sweep of all the brass fixtures.

Spare Parts and Repairs

When a new machine is purchased, there should always be bought at the same time a number of spare parts, which should be kept on hand to be used as needed. No man can build a machine that will not break down in some vital part sooner or later. A breakdown in a construction job means not only a delay, but a waste of money, for even if men can be laid off and not paid, or can be given other work, yet the job, due to the changes made necessary by the breakdown, will not be worked in the most economical manner. It is true that many contractors do keep some spare parts, but they seldom have enough on hand, or the proper ones, due to the fact that as the parts are used to replace broken ones, new ones are not order from the factory. Then one of two things occurs: the job is shut down or some part of it, or the machine is worked with the broken part until a new one can be ordered and put in place. This means that the machine is racked by the work it does, doing permanent injury to it.

Small tools can be repaired promptly in a blacksmith shop. Attention should be given to these as well as to the larger machines. To prevent such tools being lost, they should not only be branded with a die of the contractor's name or initials, but they should likewise be painted with a set of colors, selected by the contractor, to designate his equipment and advertise his business. These colors can be used on the head of some tools, and in most cases on the handles. Tools so marked can be seen at some distance, and thus prevent them being stolen or lost.

Many of these suggestions seem useless, or more or less self-evident, but any one who has much to do with road construction knows that tools and machines are scattered along the entire line of a piece of new road construction, just where they were last used, and there they stay, neglected, until they are needed again. Then they are found out of order, and to repair them, frequently new parts must be ordered, some days intervening before such parts arrive. The tool or machine depreciates greatly in value through such treatment, and thus contractors are compelled to figure a heavy plant expense item against every job. The cost of caring for this equipment is much less than the depreciation figured against it from neglect.

Such extra costs mean higher prices for road work, and as there are many thousand miles of roads that need improving, every dollar wasted means less mileage built each year. Both engineers and contractors are interested in obtaining good roads, and they should do everything possible to save money in the construction of roads.

Tenders Called on Mechanical Filtration Plant for the City of Toronto

IN the municipal field the most interesting piece of work which has cropped up during the past week is the contract for a complete mechanical filtration plant, boilers, steam turbo-generator plant and all appurtenances at Toronto Island for the City of Toronto. Tenders for this installation must reach the chairman of the Board of Control at the City Hall, Toronto, not later than noon on Tuesday, January 20. Each tender must be accompanied by a marked cheque or cash deposit equal to 2½ per cent. of the contract price.

Capacity of filter plant.—The Filtration plant is to be capable of satisfactorily filtering continuously, 60 million Imperial gallons of water every twenty-four hours, with a maximum of not less than 30 million Imperial gallons during any ten hours when discharging effluent into present clear water reservoir at Elevation 45, Toronto datum. When filtering at the aforesaid rates, the filtered water shall be of the standard of purity required under these specifications.

Bacteria removal, and efficiency.—Each tender must be accompanied by a report of some similar plant, municipal or otherwise, of at least one-half million gallons daily capacity, such report having been made by a reputable disinterested bacteriologist, showing:—

(a) The daily bacteriological analyses of the water before and after filtration for a continuous period of at least thirty days, including the percentage of B. Coli organisms removed, as well as the percentage of the total number of bacteria.

(b) The removal of suspended matter, and the nature of the effluent.

The contractor will be required to guarantee that the mechanical filtration plant, which he proposes to furnish, will remove 90 per cent. of all organisms where there are 50 to 500 bacteria per cubic centimetre in the unfiltered water; will remove 95 per cent. of all organisms where there are 500 to 2,000 bacteria per cubic centimetre in the unfiltered water; and 98 per cent. of all organisms where there are 2,000 or more bacteria per cubic centimetre in the unfiltered water.

The contractor must also guarantee removal of 98 per cent. of the B. Coli as determined by the standard methods for the examination of water of the American Public Health Association.

All turbidity must be removed, leaving a bright, colorless water, free from taste. Such results must be guaranteed by the use of not more than one grain of alum per Imperial gallon of water, under average conditions. Where such is required, a sedimentation period of not less than three hours must be provided for after the addition of alum.

Location and examination of site.—The location of the filtration plant will be adjoining the present slow sand filtration plant, on Toronto Island, and all bidders are required to examine the site of the work and adjacent premises, and the various means of approach to the site, and to make all necessary investigation in order to inform themselves thoroughly as to the character and magnitude of the work involved in the contract, also as to the facilities for delivering and handling material and plant at the site, and the conditions and the difficulties that will be encountered in the performance of the work.

Extent of the work.—The work includes the following:—(a) All the necessary foundations required for the entire work including substructures and superstructures for all buildings, coagulating basins, mixing chambers, filters and appurtenances, all pumping and other machinery, all electrical and steam apparatus, including boilers, chimney, etc. (b) The necessary coagulating basins, giving a period of sedimentation of at least three hours, these basins to be constructed entirely of reinforced concrete divided by baffles into the requisite number of bays, and surrounded by a sufficient quantity of earth to render them absolutely frost proof. (c) The necessary mixing tanks. (b) Storage room capable of storing at least six months supply of chemicals. (e) It is the intention to utilize the present clear water reservoir which has an area of 2.2 acres with a depth of 12 ft., but it is probable that some bidders may require a clear water basin. If so, cost of same must be included in tender. (f) The necessary number of mechanical filter units of four million Imperial gallons each, or approved equivalent. These units to be complete with all appurtenances. Filters will be grouped on both sides of the piping gallery, which will be utilized as an operating platform. Filter tanks to be of steel or reinforced concrete. (g) The low lift pumping machinery shall comprise three centrifugal pumping units, each of not less than 36,000,000 Imperial gallons capacity per 24 hours. Units to be capable of pumping from an elevation of 30 (Toronto datum) to whatever height is necessary for delivering the water to the filters. (h) Wash water pumps connected to the tank. (i) Air blowers. (j) All piping and connections from shore end of existing intakes to pumps, including hydraulically-operated valves, together with well and surge overflow. (k) Turbo-generator sett, including exciter and all connections. (l) Switchboard, etc. (m) Boilers, steam piping, flue connections, etc. (n) Chimney, foundation of same, and lightning conductor, etc. (o) Coal storage building capable of storing not less than 1,500 tons of coal.

LETTERS

A Contractor's Viewpoint

Toronto, November 26th, 1913.

Editor Contract Record:

We have read your articles, "The Gratuitous Bid" and "Competitive Tendering," in your issue of November 12 with much interest and heartily endorse the views expressed in each. At the same time we feel that one or two more points might have been made advantageously.

Both articles, as we understand them, presuppose that the contractor has been supplied with a bill of quantities (presumably correct) covering the branch of work for which he is to tender. We will suppose also that he receives a set of plans, showing, in a general way, the style, etc., of the building to be erected or the work to be performed. While an estimate based on such information requires a greater or lesser amount of time, effort and practical knowledge—not to say in many cases, considerable expense in search of detailed information which is practically useless except to the successful bidder—what shall be said of the conditions which require the contractor to take a set of plans and specifications, which have taken weeks, or often months to prepare, and grasp, in a few hours, the general idea from prints and descriptions too often of a very vague nature, and compile his own bill of quantities, in addition to all the trouble entailed in pricing the same? This, in our experience, is by far the greater task. If a mistake be found after the contract is let, there is no avenue of safety along the line of extras, as is the case where the bill of quantities has formed the basis of contract. While the time required in estimating quantities is often considerable, extending over several days, it must be borne in mind that, except in the larger concerns where an Estimating Department is a separate part of the organization, the contractor is obliged to sandwich this gratuitous work in between his other business duties, and in many cases positively neglect them, to his further loss. And not only so, but such piecemeal estimating is a frequent cause of mistakes by which the proprietor benefits.

Then, too, the necessity of preparing a tender at short notice (on the condition that if late it will not be considered) only to find—after the plans have been returned and one's bid submitted, perhaps—that the time has been extended for several days, is, to say the least, very aggravating and, in our experience, not always productive of the most economical results to the proprietor.

In all fairness the contractor should be given a set of plans and specifications to keep until the latest possible date, so that all available thought and time may be given to the work while the only avenue of reference is open before him. We would go still further and say that he should be allowed to keep them until the contract is awarded, as it is often the case that plans are altered, or annotated, during the reception of bids, which renders someone's position, to say the least, precarious.

Yours very truly,
H. N. Dancy & Son, Limited.

Competition in Public Contracts

Boston, Nov. 25th, 1913.

Editor Contract Record:

Referring to the editorials in your issue of November 12 under the titles, "Gratuitous Bids" and "Competitive Tendering," we enclose herewith as a matter of interest copy of paper by Mr. Geo. C. Warren under subject "Competition in Public Contracts."

Very truly Yours,
Warren Brothers Company.

EXTRACTS FROM MR. WARREN'S PAPER

"I believe more can be accomplished by placing even greater responsibilities upon public officials, holding them to a strict accountability for their proper exercise, and then providing adequate means for the detection, exposure and correction of any abuse of the powers which may be entrusted to them. It is, in my judgment, a serious mistake to attempt to make men honest by the passage of laws which on their face assume that all men are dishonest. I believe our laws at present are generally based too little on the fixing of individual responsibility and too much on suspicion of general dishonesty of public officials and an effort to force honesty by legal safeguards—a result which I believe can never be accomplished. If more responsibility, confidence and discretion were placed in our public officers, we would find more high class citizens ready and glad to take public office for the honor it carries and the good they can accomplish.

"Every contract is made up of three items—labor, materials and profit. Assuming the cost price of the first two to be approximately the same, there is only room for competition as to the profit to be made.

"The above suggestions naturally raise the question as to whether we have not reached the point where the principle of doing business on the competitive basis is not out of date and where we must look for the correction of abuses to publicity and the general elevation of the moral tone of business, and a higher order of integrity and efficiency in all public servants, coupled with the elimination of the political 'Boss' in its generally accepted, and rather uncomplimentary, sense and recognize that every organization, political or otherwise, must have a leader who may in the case of public service be honest and work to the public good.

"Let us proceed on the theory that all men are born honest and that most men would prefer to remain so and generally will remain so if encouraged to give the best that is in them and if given a remuneration for service which is consistent with their effort and responsibility and which will enable them and their families to live as people in their stations should live and, in addition, save a reasonable amount. This applies with equal force to contractors as well as public officials. How many engineers and other executive officials in our small or even large communities who are expected to devote their entire time to the work, are paid salaries which are so small as to be entirely inconsistent with the positions they hold, the results they are expected to accomplish and the expenses of living in a way such men should live to be a credit to themselves and the public? How frequently does it occur that the public is pleased when there is evidence that a contractor has taken a contract at a low price—one which cannot yield a profit and will surely yield a loss if honestly administered?

"Is not the whole system of competitive bidding and award of contracts to the lowest bidder (regardless of responsibility, including previous experience in the line of work undertaken, evidence of honesty of purpose or otherwise and of the profit or loss on the work) based on the wrong principle of grinding the contractor down to a basis on which he cannot live and carry out his contract honestly ruinously excessive competition in other words?

"Do not such conditions as to both officials and contractors breed and encourage, if not almost force dishonesty on the part of both?

"In any reform we undertake let us assume that officials (engineers or otherwise) as well as contractors are honest and place in the officials the responsibility and the confidence which that assumption would carry with it. Then pay the officials fair salaries and you will generally get good service, although at times in public as well as private life there will be an occasional wrong-doer.

"Let the contractors understand that their bids will be as readily rejected if too low as if too high and that experience, responsibility and general reliability in the past will weigh as heavily in determining the award as the amount of the bid in dollars and cents. Would any of us if we were to build an expensive house hire an architect who would work at the cheapest rate and then advertise for bids and say to the contractors—"The man who offers to do the work for the least money and gives a surety company bond will get the work?" What kind of a house would ge get on that plan? In such cases do we not consider price as only one of the many important factors for consideration in awarding the contract? Who has ever heard of satisfactory result through surety bond after the contractor has failed because the contract price is too low?

"The specifications should be clear and distinct and as brief as practicable. They should avoid all trick clauses and at the end of every paragraph should state under what item of the contract and bid the work embraced in that paragraph is to be paid for. 'Discretion of the engineer' should be eliminated and yet some things must be left to the 'best judgment' which is another way of stating 'discretion' of the engineer, but its exercise should always be fair. Too often the engineer considers his duty is to get all he can for his employer, however unfair to the contractor. In such cases it is only to be expected that the contractor will do his best to 'recoup' and the engineer who is so narrow as to take advantage of the contractor is generally sufficiently dense so that the contractor can find a way to 'put one over' on him.

The Unbalanced Bid

"This is the most potent means of exercising dishonesty. It is only made possible through unbalanced quantities of the engineer's estimate, whether the error in estimate is due to dishonest design, to incompetence, or to undue haste or lack of care in making the estimate. Even contractors with an honest purpose are pretty apt to avail themselves of an opportunity to 'unbalance' their bids if the estimate offers the opportunity, knowing that even if they do not 'unbalance' some one or more of their competitors are pretty certain to see the opportunity and avail themselves of it.

"Let contracts provide that if any item of a contract exceeds 20 per cent. of the estimated quantity the excess shall be done at cost of labor and materials plus fifteen per cent. regardless of the contract price for such item, and let the engineer understand that when any item exceeds the estimated quantity by more than 20 per cent. the fact will be regarded as prima facie evidence of incompetence and be followed by rigid investigation and probable discharge, if the investigation proves the error to be due to either incompetence or dishonesty. Then, at least intentional unbalancing of bids and estimates will be promptly stopped and engineers will exercise more care than they often do at present.

"In some cases the quantities cannot be accurately estimated in advance and in such cases the 'cost plus fifteen per cent.' basis of payment for the excess will check dishonesty. Never put in a contract a clause that if certain unanticipated contingencies arise the work 'will be done by the contractor without extra allowance.' Nothing could be more unfair, for instance, than a clause in specifications for a pavement that if 'soft or springy places develop in the subgrade they shall be dug out by the contractor and refilled with sound material (earth, stone, cinders or concrete) as the engineer may direct without extra charge.' Yet this is a common clause in pavement specifications, and equally unreasonable and similar clauses are found in specifications for other classes of work.

"If the contractor, in the construction, is faced with such a condition, he is sure to know he has been 'robbed,' and if he doesn't retaliate by 'stealing' some cement out of the concrete or otherwise it will be because he doesn't know how—not because he is dishonest, for he will be pretty certain to figure out in his own mind that, under the circumstances, such retaliation is honest. In every construction unforeseen contingencies are liable to occur. It is absolutely dishonest to throw the extra expense on the contractor and specifications should always provide for such cases, that such unanticipated or unforeseen work shall be paid for at 'cost of labor and material plus fifteen per cent.' or, as is the custom of the city of Toronto and some other cities, include in the specifications and contracts a long list of unit prices generally accepted as fair and reasonable which will be the measure of pay in case such unanticipated work is required. The cost and percentage basis is the more fair for both parties because a schedule of unit prices cannot be made which will be fair to all cases regardless of quantity or other conditions of the unforeseen work.

Relation of Estimate to Contract

"It has been suggested that no bid should be accepted if the price of any item exceeds the engineer's estimate by more than 10 per cent. Such a system would too much encourage engineers to make unfairly low estimated prices or to force the using of an incompetently prepared estimate as the final basis of contract. I have known cases where such a system was in vogue and on which, from my knowledge of costs, I believe the engineers systematically estimated about 5 per cent. below actual cost in order to entice the unwary contractor and get low bids. In such cases you may be sure the contractor will 'work his wits' to get even and I believe, generally speaking, will succeed in accomplishing the end at the expense of more or less poor work and still consider himself honest. So long as contracts are based on such lack of confidence and fairness between the contractor and engineer, so long will there be dishonesty in carrying out of contracts. Employ only competent engineers; pay them fair salaries treat the contractors fairly, and I believe 90 per cent. of the rascality in public work will be removed."

Contract Awards on Satisfactory Basis

Winnipeg, November 26, 1913.

Editor Contract Record:

We have given considerable thought to your discussion of "The Gratuitous Bid," but we fail to see any means whereby a system of reimbursing the contractor for making up his tender could be arranged. The contractor is in practically the same position as a firm employing salesmen; he must add cost of maintaining his sales force to his price. In our office we endeavor to estimate the percentage it costs us to secure the year's business, and that is an item to be added in figuring future work. We cannot see how it can be worked otherwise, as the men who are making estimates and securing information in regard to tenders have to be paid out of one's profits and it is only right that their expenses should become one of the items which make up the estimate.

In one of two cities that we know the local Builders' Exchange has endeavored to effect an arrangement whereby a certain amount is added to each tender to be divided among the unsuccessful bidders by the successful contractor. It is said that this keeps certain small firms in business. They live on putting in tenders, frequently merely cubing the work and making little effort to arrive at a close bid. They make sure that they are high enough and get paid for their tender.

To our mind there is practically nothing wrong with the present system. It simply means that the contractor must add a certain percentage to his estimate in making up his figures.

As to deposits with tenders, this is a system devised for the express purpose of eliminating unreliable contractors, and, as you are aware, we have lots of them.

We do not approve of the system of putting up marked cheques and leaving them as a guarantee for the faithful fulfilment of the contract. A marked cheque or a bid bond attached to the tender is all right so long as the owner will accept security bonds for the performance of the work. This is no expense to the contractor, as he knows what his guarantee bond will cost—the figure being based upon the amount of his contract—and a proportionate amount should be added to his estimate. Without a system of this kind contracts will be obtained by irresponsible contractors who have not adequate facilities for carrying out work, and this only brings misfortune on the material men and sub-contractors concerned. We believe that architects and owners should require a marked cheque of five per cent. of the tender to accompany the bid. The purpose of such a cheque being only an indication of the stability of the tenderer, it should be returned as soon as it is received and the successful bidder should be asked to put up a Security Company's bond. These conditions should be set forth in the specifications so that the contractor could make the necessary preparation and add the cost to his estimate.

A contractor is entitled to withdraw his tender any time until it has been accepted in writing by the owner; further, should the owner fail to let the work within a reasonable length of time the contractor should withdraw his tender You might look into this point, but we are informed that this is the law in Manitoba and we know of cases where action has been taken accordingly. There is no reason why the contractor should suffer loss from the change of conditions during the time the owner holds his bid, as he can anticipate these conditions a few days and withdrew his bid.

As to the employer putting up a sum equal to the amount of the contract, this is only a case of the contractor satisfying himself that the owner is in a financial condition to carry out his undertaking; if he is not, the contractor has the alternative. Had we figured upon all the work we have been asked to figure on and taken all the contracts we have been offered we should have been "broken" long ago. But there are plenty of facilities for ascertaining the financial standing of owners and these we generally use. If there is any doubt in our mind as to the ability of the owner to carry out his part of the undertaking we generally let the contract go to somebody else. Occasionally, as in a number of cases this year, conditions change radically, but, as a rule, where the owner has made proper arrangements to pay for his building he can finance the work.

Summing up, we feel that the whole question of gratuitous bidding and deposits with tenders can be solved by contractors themselves. We are of the opinion that the Contract Record can do good work along the line of educating contractors to make ample provision for the expense of their estimating department or the equivalent thereof. The system of marked cheques or bid bonds with tenders eliminates a great deal of irresponsible bidding and is in the best interests of the contracting community. Finally, the anxiety to secure work manifested by some contractors might well be replaced by care in satisfying themselves as to the ability of the owner to fulfil his responsibilities.

Yours very truly,
Carter-Halls-Aldinger Company, Limited.

Foundation Work at Regina

Montreal, Nov. 27, 1913.

Editor Contract Record:

We note in your issue of October 29th, 1913, a short article, entitled, "Foundation Difficulties at Regina." This article stated that considerable difficulty was experienced and that as piles were found to be useless a reinforced concrete mattress, five feet thick, was placed over the entire area, thus adding materially to the cost. None of these statements is in accordance with the facts. No serious difficulties have been encountered and the foundations are at the present time in place, concrete piles of the Raymond type having been used with very satisfactory results. During the driving of the piles the earth in the trenches kicked up to some extent, but otherwise nothing unusual took place.

We might say that the method which you mention of using a continuous reinforced mattress for the entire site was considered, but was rejected as not being feasible and as being prohibitive as regards cost.

Yours truly,
Ross & Macdonald.

Report on Refuse Disposal at Montreal

By Mr. R. S. Lea

TWO projects for the disposal of refuse in Montreal are suggested in a long report submitted by Mr. R. S. Lea. Although the installation of a combined destructor and reduction plant is considered to be the ultimate choice, recommendation is made to the controllers that the final selection of the scheme be deferred another six months or a year to permit the collection of data with respect to the quantity and character of the various classes of refuse collected in Montreal.

The two schemes suggested by Mr. R. S. Lea, who has inspected the different plants in operation in large European and American cities, are the following:

The installation of a destructor plant of the British type for the incineration of the total refuse, garbage, ashes and rubbish. The gross revenue from this proposition would be represented chiefly by the value of the net power available from the operation of the plant.

The installation of a combined destructor and reduction plant for the incineration of ashes and rubbish in the destruction plant and the treatment of garbage in the reduction plant for the recovery of grease and fertilizer. The steam for the operation of the reduction plant would be obtained from the destruction plant. The gross revenue from this proposition would be represented by the proceeds from the sale of grease and fertilizer and by the value of such surplus power from the destruction plant as might be available over and above what is required for the operation of the reduction plant. Additional revenue might materialize in the case of both propositions from the sale of clinker or its utilization by the city and, moreover, if it should appear profitable the so-called refuse utilization plant could be established in connection with either proposition for the recovery of the marketable portions of the rubbish.

A Distinguished British Engineer

SIR Alexander Binnie, the eminent English expert, has been identified with many important engineering undertakings in his time, but none of these has won for him in Canada the fame that attaches to the solution of the Ottawa water supply problem. Sir Alexander has submitted to the Ottawa City Council a report, which they have adopted, for bringing water from Thirty-One Mile Lake at a cost of $7,985,000. The seal of approval has been given to the report by Dr. A. C. Houston, chemist and water examiner of the Metropolitan Water Board of London. Details were given in our issue of October 29.

The adoption of Sir Alexander's report followed the rejection by popular vote of two successive plans recommended by Sir Allan Hazen of New York City.

Much criticism of the Ottawa council has been forthcoming in connection with their vacillation in engineering matters—vacillation which has cost the city hundreds of lives and many thousands of dollars. In an editorial on the situation at Ottawa published last August, a New York contemporary described half the Ottawa electorate as "self-appointed experts" and scored the city roundly for a muddled charter and poor municipal government—government responsible for typhoid epidemics, law-suits and other tragic occurrences.

Whatever professional jealousies may have arisen on either side of the border among the many experts, of whom few were called and none was chosen, the man whose recommendations establish peace among the warring factions at Ottawa is entitled to more than passing consideration. We have pleasure therefore in giving the following biographical facts concerning Sir Alexander Binnie:

Sir Alexander Richardson Binnie was born in London in 1839. Educated privately, he was articled in 1858 to the late J. W. Flanagan, M.Inst.C.E., and on his death to the late J. F. la Trobe Bateman, F.R.S., Past President of the Institution of Civil Engineers, who carried out the great works of water supply for Manchester, Glasgow and other towns.

On the completion of his pupilage he remained with Mr. Bateman as an assistant, resigning his position in 1862 in order to take up an appointment in connection with the construction of new railways in Mid Wales. There he remained until 1865, returning to London to enter into private practice. In 1867 after examination, he secured a position as Executive Engineer in the Public Works Department of India. Delegated to the Central Provinces he was posted to Nagpur and during the time he remained there he carried out the works for the supply of that city with water, from Ambajhari, about four miles distant. It is interesting to note that after forty years these works still form the supply to that city.

During his period of service in conjunction with the late Major Lucey Smith he made discoveries of coal in the Chanda District which led to the construction of a railway and the opening up of the coalfield, for which he received the commendation of the Government of India.

In March, 1875, he was appointed Chief Engineer for waterworks purposes to the city of Bradford. During the fifteen years he held that position he repaired and reconstructed the Stubden, Leeshaw and Leeming Reservoirs and designed and constructed the reservoirs at Barden and Thornton Moor with their necessary conduits.

One of the last acts he performed before leaving Bradford was the preparation of the plans and sections for the Nidd Valley water scheme, which, after long and protracted controversy, was adopted by the Corporation and carried through Parliament in the Session of 1890. The works then authorized have since, with modifications, been carried out by his successor, Mr. James Watson.

In March, 1890, Sir Alexander took leave of Bradford having been appointed Chief Engineer to the London County Council. This position he occupied for nearly twelve years, during which time there were constructed under his directions among other things, the Blackwall and Greenwich tunnels under the River Thames, and the Barking Road Bridge over the River Lea, and he commenced the new Vauxhall Bridge which was completed by his successor.

In conjunction with the late Sir Benjamin Baker, K.C.B., K.C.M.G., he reported on the re-construction of and additions to the main drainage of London involving an estimated expenditure of about £2,500,000. These works he commenced and they have since been completed by his successor, Sir Maurice FitzMaurice, C.M.G.

He also projected and carried through Parliament the necessary works for the widening of the Strand and the important thoroughfares of Aldwych and Kingsway, connecting it with Holborn.

Sir Alexander further assisted the London County Council in Parliament in the many controversies which arose in connection with the various proposals to carry the tramways from South London over Westminster Bridge and along the Victoria Embankment, works which have since been carried out with great benefit to the public. He also conducted the engineering case of the London County Council before the Royal Commissions on Metropolitan Water Supply in 1891-3 and 1897-1900, and in the Session of 1900 he deposited plans on behalf of that Council in connection with the supply of London from the mountains of Wales.

On the completion of his engagement with the London County Council, Sir Alexander commenced private practice in Westminster, in which he was joined by his eldest son and later by Mr. Deacon. When the question of the transfer of the Metropolitan Water Companies to the Water Board occurred, he acted as principal engineering adviser to the Board and subsequently as Arbitrator in connection with the subdivision of some of the areas of the Companies.

In 1906 he reported to the Government of Ireland on the Bann and Lough Neagh Drainage and from 1905 to 1907 he acted as Chairman of the Vice-Regal Commission on the Arterial Drainage of Ireland.

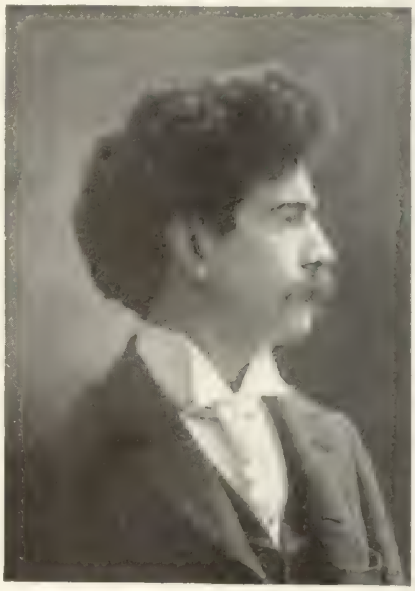
At the present time he is senior partner in the firm of Sir Alex. Binnie, Son & Deacon, civil engineers of Westminster, and is engaged in the carrying out of several large water schemes, including the new Birkenhead supply from the River Alwen in Denbighshire, and the supply of Merthyr Tydvil from the River Taf Fechan. He visited St. Petersburg in 1910 and 1911 at the request of the Russian Government to report on the water supply and drainage of that city.

On the completion of the Blackwall Tunnel he received the honour of Knighthood at the hand of the late Queen Victoria and in 1905 his professional brethren conferred upon him the highest honour in their power by electing him President of the Institution of Civil Engineers.

Canadian Municipal Engineers

H. A. McLean, Town Engineer, Sarnia, Ont.

Mr. H. A. McLean, Town Engineer of Sarnia, Ont., was born in Middlesex county and received his high school education at Glencoe and the Strathroy Collegiate Institute. After a six years' course he graduated from the State University of Michigan at Ann Arbor with the degree of Bachelor of Science in mechanical and electrical engineering. For a year he was assistant superintendent for the F. Bissell Company, of Toledo, a local electrical supply and manufacturing company; then he became chief engineer for the South-Western Traction Company, operating from London to Port Stanley, and had charge of the construction of the first section of the line. He was with the traction company for two years, after which he served for a similar period in the capacity of Master Mechanic for M. A. Piggot & Company, building the Goderich branch of the C. P. R.



Mr. H. A. McLean, Town Engineer, Sarnia.

Mr. McLean has been Town Engineer of Sarnia for the last seven years and for two years has been consulting engineer on the new water-works which the town of Sarnia is now constructing at Point Edward at a cost of $250,000. The work at Point Edward is being carried out in accordance with Mr. McLean's recommendations, which were approved by the provincial authorities.

In addition to his work for the town of Sarnia, Mr. McLean is also consulting engineer for the town of Forest where a new electric light plant is now being built and where it is proposed to install water-works—in both cases according to plans and specifications prepared by Mr. McLean. Quite recently Mr. McLean reported on water-works for the village of Point Edward whose electors will vote on a by-law in the new year.

Mr. H. E. Matthews has been elected president of the Manitoba Association of Architects for the ensuing year.

Mr. John Flanigan, a retired contractor and a resident of Brockville for nearly sixty years, died last week at the age of 77.

Mr. John William Stewart, partner in a firm of Vancouver railroad contractors, has bought a large area of the Duke of Sutherland's land.

Sir William Henry Preece, past president of the Institution of Civil Engineers and a famous British electrical engineer, died in London, Eng., recently in his eightieth year. He was an authority on telegraphy and telephony and the author of text-books on these subjects. In 1870 he was appointed division engineer of the Post Office Department. Seven years later he was advanced to the office of Electrician and in 1892 to that of Engineer-in-Chief. He was also a past-president of the Institute of Electrical Engineers and a member of the Institute of Mechanical Engineers.

Mr. Peter A. Peterson, formerly chief engineer of the C. P. R., died in Montreal on November 21st. He had a very wide experience in railway engineering, and in the early days of the C. P. R. did much in replacing the temporary bridge structures with steel bridges in the West. Before joining the C. P. R. he was connected with the I. C. R. Mr. Peterson retired ten years ago, but retained the position of consulting engineer to the C. P. R. He was responsible for designing the bridge across the St. Lawrence of which the late Sir George Reid was contractor. In 1894 he was appointed president of the Canadian Society of Civil Engineers. Mr. Peterson was born at Niagara Falls in 1839 and was educated at Toronto University, where he graduated with the degree of B.Sc.

Coming Events

The annual convention of the Canadian Clay Products Association will be held at the King Edward Hotel, Toronto, January 27-30 next. This was decided at a meeting of the executive of the Association held recently at the King Edward Hotel. The President of the Association is Mr. Chas. H. Millar, of Price's, Limited, Toronto, and the Secretary is Mr. John Walsh, of Mr. Jos. Russell's brick works, Toronto.

The tenth annual convention of the Sand-Lime Brick Association will be held at Harrisburg, Pa., December 9-10. The convention will be called to order on the morning of Tuesday, Dec. 9, by the President, Mr. S. O. Goho. On the opening day the delegates will visit the plant of the Hummelstown Brownstone Company at Waltonville, Pa. A number of interesting papers are scheduled for presentation on Wednesday, December 10. Among these may be mentioned: "Sand-Lime Brick in Canada," by Mr. G. Silvester, of Calgary, Alta.; "Essentials for Success in the Manufacture of Sand-Lime Brick," by Mr. W. H. Crume, of Dayton, Ohio, and "An Analytical Study of Brick Specifications," by Mr. W. E. Emley, U. S. Bureau of Standards, Pittsburgh, Pa.

The Fourth Annual Good Roads Congress and Exhibition will be held in Philadelphia, Pa., December 9-12, in accordance with announcements made in previous issues of The Contract Record. The meeting is the occasion of the Tenth Annual Convention of the American Road Builders' Association of which Mr. E. L. Powers, 150 Nassau Street, New York, is the secretary.

A junior architectural club has been formed at McGill University by the students of the Department of Architecture. At its meetings addresses will be given by men prominent in the profession. Membership is to be extended beyond the university, to all junior draughtsmen in the city. The officers elected for the year are: President, W. C. Hyde; vice-president, J. L. Robertson; secretary, H. G. Henson; treasurer, R. W. Robertson; advisory board, Prof. Ludlow, Prof. Groquair, C. Booth, M. Todd, and W. A. I. Anglin.

Mainly Constructional

The News in Brief—From Coast to Coast

Plans are now being prepared for four large buildings which will be added next year to those already comprising the University of Saskatchewan and upon which over $2,000,000 has already been expended.

The Montreal Council have decided to seek powers from the Quebec Legislature to compulsorily set aside each year for the laying of permanent pavings a sum of not less than $1,500,000, to be taken out of the loan fund.

The Guild of Civic Art has notified the Mayor of Toronto that it will oppose any further violation of the city's building by-laws. It fears that Council will permit the erection of a twenty-storey hotel facing the City Hall on the corner of Queen and Bay streets.

That the Provincial Government of Victoria, B.C., has expended four million dollars on road extension and highway improvement in the past season is the announcement made by the Minister of Public Works, Hon. T. W. Taylor. There is also on hand a sum of 10 per cent. of the amount for maintenance.

Judgment was given at Osgoode Hall in favor of Mr. Alfred Rogers in an action against the National Portland Cement Company, of Durham, for $54,000 damages for breach of contract. It appeared that the contract between the parties had been broken by the defendant company because it desired to reduce its selling expenses.

The Thames Quarry Company, Limited, St. Marys, Ont., are installing a plant for the manufacture of cement stone brick. The machinery is being supplied by Wettlaufer Bros., Toronto. The press has a capacity of 15,000 a day. The company intend putting in a second press in the near future. They will be manufacturing in four or five weeks.

The new wing of the Infants' Home and Infirmary, 21 St. Mary Street, Toronto, has been opened. The new addition, which stands southeast of the old building, cost $60,000. Messrs. Wickson & Gregg designed the structure, which is thoroughly fireproof, having cement floors, fireproof doors and staircases. A feature is the roof nursery covered by sheet metal.

In view of the fact that there is little likelihood of an early sale of school debentures, the Board of School Trustees of Victoria, B.C., at its last monthly meeting determined that no further contracts for the construction of new schools be let. This action of the board means that the work on the new Quadra Street, Hollywood and Beacon Hill schools will not be proceeded with.

The estimated amount to be raised by the County of Essex, Ont., for the good roads scheme is $787,500. Of this amount Windsor is expected to contribute $60,000 and Wakefield $30,000, which will leave $697,500 to be provided by the county. In order to raise this amount the sum of $45,737 will have to be raised each year for thirty years, or $55,969 a year covering a term of twenty years.

Estimates totalling fifty million dollars have been prepared by the Public Works Department at Ottawa. This is about two million in excess of last year. No new works are provided for, but those in progress already are so extensive and require such a large outlay that it is difficult to reduce the amount. Harbor improvements, dredging and the construction of dry docks provide the principal items.

The action of the waves in a recent storm exposed a stratum of earth containing stumps, trees and branches filling in the canal north of Port Huron which connects Lake Huron with Black River and which was just completed a little over a year ago. Geologists claim that the exposing of this strata of earth proves that a forest once flourished hundreds of years ago where now it is but the lake shore.

Messrs. John McKay & Company, the firm of auditors retained by Mayor Hocken, of Toronto, to report on the advisability of purchasing the street railway and the Toronto Electric Light Company, have presented their report, which is practically an endorsement of the proposition, provided the contracts for power can be renewed. The price asked for the two franchises and rolling stock is thirty million dollars.

The rear portion of a seven-storey building nearing completion collapsed recently at Cedar Rapids, carrying with it fourteen men who were working on the roof. The concrete in the seventh floor had been poured two weeks previously and the roof of slab over the remaining portion of the building was just put in place. A portion of it gave way and fell to the sixth floor where the concrete had not hardened, and in a few seconds all the floors beneath were lying in a huge pile in the basement.

The Kamloops, B.C., new power station, opened recently, is another of the many important projects carried through by this progressive city. This station will be a part of the Hydro-Electric System, the total cost of which will reach half-a-million dollars and will give Kamloops all the additional power needed for many years. The new power station is a massive reinforced concrete building, 80 ft. x 90 ft., which, with its 175 ft. stack, makes it an imposing landmark. The machinery installed is the latest and best type.

The new office building of the Quebec Central Railway Company on Wellington and Strathcona Square, Sherbrooke, has been completed by the contractors, Messrs. Loomis-Dakin, Limited. One part of the ground floor will be occupied by the Canadian Pacific Railway as a ticket, telegraph and express office, and two of the upper floors will be utilized for the Quebec Central Railway Company's general offices. The new building is of solid brick with steel frame construction. The floors throughout are of reinforced concrete and all the partitions are fireproof. It has a frontage of 81 feet, width of 62 feet and a height of 80 feet.

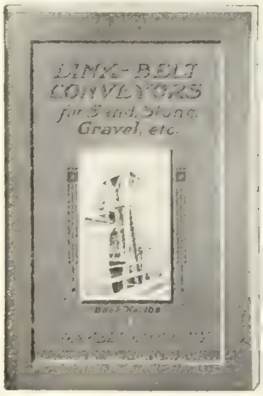
About two million dollars will be spent by the Government on the ferry service between Cape Tormentine, N.B., and Carleton Point, Prince Edward Island. Mr. J, O'Brien's contract on the New Brunswick side amounts to half a million, the ferry steamer will cost about the same, and Mr. Roger Miller will construct the ferry terminal at Carleton Point at the cost of nearly a million. Mr. Miller will build out some 2,500 feet, the structure to be of concrete, and the work will require two seasons to finish, and as there is no local labor market most of the large force to be employed there next season will have to be secured outside the island.

According to a statement submitted to the Edmonton Commissioners by Building Inspector McIvor, the number of building permits issued during the year commencing November 1, 1912, and ending October 31, 1913, total in value $10,243,567. Comparing this amount with that of the previous year it is found that 1913 has fallen behind its predecessor to the extent of $2,973,645. Notwithstanding the causes of curtailment of building permits this season, Edmonton's record of over $10,000,000 of building indicates the rate of development of that city. During October last the department inspected 772 buildings, 405 plumbing jobs and 212 sewer connections.

A decrease of $299,850 took place during the last fiscal year in the value of permits issued at Hamilton. Altogether there were 1,351 permits granted, totalling a value of $5,083,050, as compared to $5,382,900 the year before, and $4,073,105 in 1911. In his annual statement Inspector Anderson says:—"The value of brick residences erected this year is $309,700 over that of 1912 which shows that the dwellings erected during 1913 were of a better class than those erected the previous year. The same trouble still exists with the cement foundation contractors as last year. Eighteen concrete foundations were pulled down, causing two police court cases, wherein convictions were secured."

Reports from Winnipeg indicate that despite the lateness of the season there is still considerable activity in building circles. Plans have been drawn for a large apartment block and an extensive wholesale warehouse, while the National Construction Company have made application for a permit to erect a power house for the Provincial Government, which, when completed, will supply power to the new law courts, parliament buildings and land titles office. The foundations of the building are practically completed and a good percentage of the concrete footings are in place. The building, which will cost about $160,000, will be constructed of cut stone to conform with the architecture of the law courts. The permits for the year exceed $18,000,000.

The Link-Belt Company has just published a new booklet entitled "Link-Belt Conveyors for Sand, Stone, Gravel, etc.," an illustration of which is shown herewith. It shows some of the company's rugged installations of continuous bucket elevators, and stone carriers and numerous equipments used by contractors and dealers throughout the country. Probably the most interesting page to sand, stone and gravel dealers, as well as contractors, is that relating to the new Link-Belt Portable Gondola Car Unloader, which it is claimed will unload a railroad car at the rate of 50 tons an hour. It is made either portable or stationary and several equipments have already been installed in Philadelphia. Copies of the new booklet, we understand, will be mailed to interested parties on request to the Link-Belt Company, Philadelphia or Chicago.



M. Beatty & Sons, Limited, of Welland, Ont., have just closed a contract for a steel dipper dredge with hull 100 ft. long, 40 ft. beam and 10 ft. deep, delivery to be made May 1, 1914. The dredge is of the crane type with dipper handle and spuds of sufficient length to make 40 ft. of water. The dipper itself is of five yards capacity. The Beatty firm are building this dredge for the C. S. Boone Dredging & Construction Company, of Toronto, who will use it on one of the large harbor improvement works they secured during the past season. This 5-yard dredge is similar to the dredges previously furnished the Canadian Dredging Company, Midland, Ont., W. E. Phin, Hamilton, Ont., The Dominion Dredging Company, Quebec, and others. It has done admirable work for different firms in a wide variety of material, and has established good records for capacity and low cost of maintenance. Quite recently the firm launched two steel dump scows, 156 ft. x 36 ins. x 14 ft., each of 800 cubic yards capacity. On one of the vacant ways they will at once lay down the 5-yard dredge and on the other will proceed with the construction of the lock gate lifter for the Trent Valley Canal, the contract for which they were awarded by the Department of Railways and Canals.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Camrose, Alta.
Sewer cleaning rods required by Municipal Council. Commissioner and Engineer, Sydney Appleton, Box 327 P. O. Camrose. Tenders received by Commissioner for one set sewer pipe cleaning rods (600 ft. long) suitable for 8-inch vitrified pipe. Diameter of manholes 3 ft. 6 in. f.o.b. Comrose.

Guelph, Ont.
Storm drain is contemplated by City Council. Mayor, Samuel Carter. Clerk, T. J. Moore.

Montreal, Que.
Sidewalks and roads, St. Lambert, cost $26,800, contemplated by Corp. of St. Lambert. Engineer, E. Drinkwater, St. Lambert. Tenders to be called in spring. Concrete walks and tar macadam roads.

Oak Bay, B.C.
Waterworks, cost $35,000, planned by Municipal Council. Clerk, F. W. Clayton. By-law passed.

Ottawa, Ont.
Sewer, cost $1,281.15, is contemplated by City Council. Clerk, Jno. Henderson. 12 in. tile pipe sewer on Gladstone Ave. and Hurdman Rd., from King Edward Ave. to C. N. R. Station.

Asphalt pavement, cost $4,696.56, between Cumberland St. and King Edward Ave., is contemplated by City Council. Clerk, Jno. Henderson. City Engineer, Arch. Currie.

Intercepting sewer, cost $56,827, planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie, City Hall. General contractor, Thos. McLaughlin, Sterling Ave. Work has been started.

Concrete sidewalks, cost $1,118.90, walks on east side Leonard Ave. and east side Forest St., is contemplated by City Council. Clerk, Jno. Henderson.

Winnipeg, Man.
Park improvements, cost $110,000. Board of Control. Sec., M. Peterson. City Clerk, C. J. Brown. By-law to be voted on Dec. 12th. Above amount includes cost of erecting a permanent bridge over Assiniboine River into the Assiniboine Park.

Pumping machinery for sewage pumping station, $862. General contractors. Fairbanks-Morse Co., Ltd., 300 Princess Street.

Water mains planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction, City Yards. Watermains in Cameron street, $102.90; Beach Ave., $230.40; Talbot ave., $568.50.

CONTRACTS AWARDED

Regina, Sask.
Sewage disposal works planned by City of Regina. City Commsr., S. A. Thornton. Engineer, F. McArthur. General contractor, O. W. Smith, 4 Peart Block. Contract for 9,025 concrete blocks awarded to Freeland Bros., St. John St. N.

Metcalfe Twp., Ont.
Tile drain planned by Twp. Council. Twp. Clerk, R. Ward, Strathroy Twp. General contractor, J. B. McMahon, c/o R. Ward. Construction of the O'Neil Drain.

Toronto, Ont.
Sewers planned by Board of Control. General contractors, J. H. McKnight Constr. Co., 88 St. David St. Dufferin St., $14,445, midway drainage system, Gerrard and Hiawatha, $4,445. J. F. Connolly, 606 Avenue Rd., Benlamond Ave., $1,942.

Grading required by Board of Control. General contractors, Britnell Contracting Co., 209 Davenport Rd. Grading on Springmount Ave. and Mount Royal to Rosemount, $10,350.

Pavements planned by York Twp. Clerk, W. A. Clarke, Jarvis St. Engineer, Frank Barber, 57 Adelaide E. General contractors, Rocmac Roads Ltd., 74 King E. Rocmac on Spadina Rd.

Pavements planned by Board of Control. Mayor, H. C. Hocken. General contractors, Constructing & Paving Co., Confed. Life Bldg., asphalt on Grange and Theodore Ave., $10,385, asphaltic concrete on Argyle, $7,003. General contractors, Grant Contracting Co., 50 Front E., brick block on Derby Lane, $2,595.

Asphalt pavements planned by Board of Control. General contractors, Godson Contracting Co., Manning Chambrs., Arlington Ave., $8,400. General contractors, Constructing & Paving Co., Confed. Life Bldg., Carns Ave., $1,822. General contractor, Commr. of Works, by day labor, on Alma, Johnsons Lane, Rushton Rd. and Wells Hill Ave., also bitulithic on Arlington Ave.

Sewer, cost $7,230, planned by York Twp. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide St. General contractor, J. F. Connolly, 606 Avenue Rd.

North Vancouver, B.C.
Passenger subway, cost $30,105, planned by Municipal Council. Dist. Engineer, J. R. Cosgrave. General contractors, M. P. Cotton Co., Ltd.

Winnipeg, Man.
Watermains planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction, City Yards. Watermains on Dunfra Ave., $273.30.; McGregor St., $126,50; Armetta Ave., $148.50.

Railroads, Bridges and Wharves

Balsam Lake, Ont.
The C. P. R. has been authorized to construct spur for J. L. Abbott, Toronto, in W. ½ Lot 16, Con. 7, Twp. Eldon, Co. Victoria, at mileage 35.07, Ont. Div., Port McNicoll Sub.-Div.

Barrie, Ont.
The G. T. R. has been authorized to construct siding into premises of Messrs. Whiteside & Arnold, on lots 2 and 3, South Tiffin St., Allandale.

Province of B.C.
The G. T. R. has been authorized to construct bridge across Kitssumkaylum River at mileage 91, Prince Rupert East B.C.

Gravelbourg, Sask.
Plans showing location and details of special station to be constructed by C. N. R. have been approved.

Grands Mechins, Que.
Wharf extension planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until 4 p.m. Dec. 22nd. Plans, etc., at offices of Dist. Engineers, Rimouski, Post Office Bldg., Quebec, Postmaster, Grands Mechins, and at Dept., Ottawa.

Gravel, Ont.
The location of station at Gravel, for C. P. R., mileage 32.50 Lake Superior Div., Nipigon Sub. Div., Ont., has been approved.

Maidstone, Ont.
Location of Windsor, Essex and Lake Shore Rapid Rly. Co. station, Twp. Sandwich South, has been approved.

Montreal, Que.
Roofing shed planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Tenders received by Sec. until 12 o'clock noon Dec. 11th for roofing of St. Gabriel Shed No. 1, Ottawa St., Lachine Canal. Plans, specifications, at office of Chief Engineer of Dept., Ottawa, Suptg. Engineer of Quebec Canals, New Birks Bldg., Montreal.

The C. P. R. has been authorized to construct spur for Joseph Elie.

New Westminster, B.C.
Sub-station is contemplated by Vancouver Power Co., 16 Hastings E., Vancouver. Work to start shortly. Two storeys, concrete construction.

Ottawa, Ont.
Temporary bridge contemplated by City Council. Mayor, J. A. Ellis. The above bridge will not now be built.

Bridge, cost $50,000, planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie, City Hall. Steel bridge 60 ft. wide, concrete abutments and piers, approximately 2,500 cu. yds. cement and 500 tons steel. Tenders for concrete work to be called in about 3 weeks, and steel about 1 week later. Plans in progress.

Province of Ontario.
Plan showing two new abutments for replacing piers at C. P. R. bridge at mileage 35.4 on Chalk River Sub-div. has been approved.

Pritchard, B.C.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until 4 p.m. Dec. 15th. Plans, etc., at office of the Dist. Engineers, Chase, B.C., New Westminster, Postmaster, Pritchard, and at Dept., Ottawa.

Renfrew, Ont.
The C. N. O. Rly. has been authorized to construct bridge to carry its line over Indian River, Twp. Richards, Co. Renfrew, at mileage 107.85 from Ottawa.

Rosseau, Ont.
Humphrey Twp. Council contemplate building a new steel bridge over Broad River. Clerk, A. A. Young.

St. Anne Des Monts, Que.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. No action to be taken.

Saskatoon, Sask.
The C. P. R. has been authorized to construct spur for Quaker Oats Co.

Toronto, Ont.
Bloor E. Viaduct planned by Board of Control. Mayor, H. C. Hocken. Plans nearly completed. Tenders to be called after Jan. 1st.

Plans have been approved for the new steel trestle for C. P. R. Don Viaduct. To be constructed to allow thoroughfare under same.

The C. P. R. has been authorized to construct siding for Cowan Co., Ltd., at Parkdale.

St. Cesaire, Que.
Montreal & Southern Counties Railway has been authorized to construct bridge to carry its line across Yamaska River.

Victoria, B.C.
New plans for Johnson St. Bridge are being prepared by City Council. Clerk, W. J. Dowler.

Vancouver, B.C.
Four viaducts, cost $540,000, planned by City Council & Great Northern Rly. Co. City engineer, F. L. Fellowes. Engineer has completed plans for viaducts at intersection of Hastings, Pender, Keefer and Harris Sts.

Weyburn, Sask.
G. T. P. Rly. freight shed, cost $15,000. One storey, 40 x 244, platform, 200 x 40, frame construction, cement foundation, floors, felt and gravel roofing. Tenders to close as soon as possible.

Whitehall, Ont.
The G. T. R. has been authorized to construct siding for Arthur Sherk into premises of Northern Veneer Co., Ltd., on lot 28, Con. 11, Twp. McMurrich.

CONTRACTS AWARDED

Shelter Point, B.C.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Hodgson, King & McPhalen Bros., 319 Pender St., W. Vancouver.

Victoria, B.C.
Concrete conduit, cost $329,750, planned by City Council. Water Commr., C. H. Rust. General contractors, Pacific Lock Joint Pipe Co., Victoria. 27½ miles reinforced concrete pipe and apparatus on the line of the Sooke Water Supply Conduit.

Public Buildings, Churches, Schools, etc.

Aurora, Ont.
School buildings contemplated by St. John's Industrial School, Kingston Rd., Toronto. Archbishop, N. McNeil, Wellesley Place, Toronto, has purchased new site near Aurora, where new building will be erected shortly.

Brussels, Ont.
Church, cost $20,000, for Melville Presbyterian Congregation. Pastor, Rev. A. J. Mann. Architect, J. S. Russel, 21 Downie St., Stratford. Plans in progress.

Cobalt, Ont.
Post office fittings required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received until Dec. 9th for interior fittings. Specifications at P. O. Cobalt, Office of Sec., Station "F," Toronto.

Cochrane, Ont.
School, cost $25,000, is contemplated by Public School Board. Sec., J. McD. Douglas. Plans will be received by Board. Work to start in spring. Eight rooms, solid brick construction, concrete foundation, felt and gravel roofing, electric lighting, birch floors, line and sand plastering, slate blackboards, seating.

Edmonton, Alta.
Church for Gaelic Organization. Rev. Dr. MacLean, Bonnie Doone. Sub.-Div., Edmonton S. Work to start in spring. Plans in progress.

Fredericton, N.B.
Normal school annex, cost $45,000, planned by Prov. Govt. Dept. of Public Works. Commr., Hon. Jno. Morrissy. Architect, G. E. Fairweather, Germain St., St. John. General contractor, J. Fred Ryan, Fredericton, N.B. Roofed.

Hamilton, Ont.
Sub-station, cost $15,000, planned by City Council (Hydro-electric Dept.). Mayor, John Allan. Consg. Engineer, E. I. Sifton, City Hall. Architects, Watt & Blackwell, 125 Lister Chmbrs. Mason, W. H. Yates, 18 Leeming St. Carpenter, T. J. Drake, Earl St. Roofing, J. E. Riddle & Son, Ferguson Ave. N. Plumbing, A. Rogers & Co., 758 King St. T. Iron work, Kingdon Smith Co., King William St. Two storeys, steel and brick construction, concrete foundation, comp. paper roofing, electric lighting, steam heating, concrete floors, metal sash.

Kuper Island, B.C.
School buildings, cost $50,000, planned by Dom. Govt. Dept. of Indian Affairs. Sec., J. D. McLean, Ottawa. Plans prepared. Tenders to be called shortly.

Lachute, Que.
A college is contemplated by R. C. School Commrs.

London, Ont.
Addition to high school, cost $65,000, planned by Board of Education. Chairman, E. R. Dennis. Architects, McBride & Gilbert, Edge Block. Tenders will be called in spring. Stone and concrete foundation, white brick construction, electric lighting, maple and concrete floors, plumbing, lime and sand plaster, seating, slate blackboards. Plans in progress.

Memramcook, N.B.
College extension and power house, cost $70,000, for St. Joseph's College, Memramcook, N.B. Architect, R. A. Frechet, 30 Bonicord St., Moncton, N.B. General contractor, S. R. Gundet, College Bridge. Roofed.

Montreal, Que.
Church for Parish of St. Jean Baptiste. Architect, J. L. D. Lafreniere, 271 St. Denis St. Plans in progress. Tenders to be called in about two months.

Church for St. Lukes Congregation (W. R. Cruikshanks, 115 Drummond St.) Architects, Hutchison, Wood & Miller Royal Ins. Bldg. Architect now ready to receive tenders for General Contractor. To close Dec. 3rd.

Ottawa, Ont.
School, cost $140,000, Rosemount, planned by Ottawa School Board. Sec., Crawford Bros., Elgin St. Architect, W. B. Garvock, Creighton St. School. Roofing, Architectural Sheet Metal Co., Vaughan St. 18 rooms. Walls up.

St. Catharines, Ont.
Addition to school, cost $25,000, contemplated by School Board. Chairman, Jas. A. Hewitt. Four room addition to school in St. Patrick's Ward.

St. Thomas, Ont.
Y. M. C. A., Talbot St. Architect, Jno. T. Findlay. General contractor, A. E. Ponsford, 605 Talbot St. Other contracts not let. Excavating.

Sandwich, Ont.
Addition to registry office, at $20,000, planned by Essex County Council. Chairman, Enos McCausland, Essex. Architect, J. C. Pennington, Windsor. Mason, Thompson Bros., Windsor. Carpenter and roofing, Williamson Construction Co., Walkerville. Iron and steel, Canadian Bridge Co., Walkerville. Painting, C. M. Bennett, Walkerville. Heating and plumbing, R. Paddon, Windsor. Electrical, James Clark, Windsor. One storey, 50 x 50. Foundations in.

Sarnia, Ont.
School, cost $30,000, planned by School Board. Chairman, A. N. Hayes, M.D., 142 Christina. Architect, Robt. W. Fawcett, 152 Essex St. Work to be done by day labor. Ten rooms, steam heating, ventilating system, 48 ft. by about 4 ft. High blackboard required in each room. Work to start.

Toronto, Ont.
Machinery hall, etc., cost $600,000, for Canadian National Exhibition Board. General manager, Dr. J. O. Orr, City Hall. Directors have approved of the following:—New machinery hall, addition to Art Gallery, Live Stock Arena, Sheep Pens, reconstruction of Poultry Bldg., alterations, etc., Grand Stand.

Vancouver, B.C.
Addition planned by General Hospital Board. Managing Secretary, Geo. Had-

don. Architect, A. A. Cox, Cotton Bldg. Tenders received by Sec. until 5 p.m. Dec. 3rd. Plans, etc., at office of Architect. Service wing, estimated cost between $90,000 and $100,000. Three stys., mill and brick construction.

Nurses Home, cost $110,000, for General Hospital Board. Managing Sec., Geo. Haddon. Architect, A. A. Cox, Carter-Cotton Bldg. Tenders received by Sec. until 5 p.m. Dec. 3rd. Plans, etc., at office of Architect. Five stys., mill and brick construction.

Victoria, B.C.

Public swimming baths contemplated by City Council. Clerk, Wellington J. Dowler. The following Committee has been appointed to look into matter:—Messrs. L. F. Leo, P. R. Pomfret, W. J. Keir, C. E. Hopper, W. D. Muir, E. B. Paul, I. St. Clair, Mrs. Pringle, Mrs. Hay, Miss Bradshawe.

Welland, Ont.

Re-building court house, cost $16,000, planned by County of Welland. County Clerk, R. Cooper. General contractors, Clark & Son. About ready for roofing.

Winnipeg, Man.

School, cost $90,000, planned by Rural Municipality of Assinaboia, St. James. Sec.-Treas., Frank Ness, Kirkfield Park P.O. Architect, Alex. Melville, 4th floor, Builders' Exchange. General contractors, Frid Lewis & Co., Somerset Bldg. Three storeys, 135 x 85. Foundations in.

CONTRACTS AWARDED

Fruitlands, B.C.

School planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractor, Chas. B. Austin.

Mission City, B.C.

School, cost $7,500, planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractors, Catherwood & Slack, Mission City. Two rooms, frame construction.

Montreal, Que.

Alterations to church, cost $30,000, for St. Charles Parish, 401 Centre St. Architects, McDuff & Lemieux, University St. General contractor, C. E. Deakin, 41 Mayor. Repairing present basement and covering same in with concrete and steel, concrete floors. Two storeys, 125 x 225, stone and concrete foundation, stone and steel construction.

Alterations to hospital, cost $12,000, for Notre Dame Hospital, Notre Dame St. E. Architect, Alp. Piche, 52 Victoria Sq. General contractor, P. Belair, c/o Architect. Four storeys, 74 x 140, concrete foundation, stone and steel construction, hot water heating.

Port Dover, Ont.

Public school, cost $21,000, planned by Board of Education. Sec., T. W. Smith. Architects, Chapman & M. Giffin, 95 King St. E., Toronto. General contractors, P. H. Secord & Son, 133 Nelson St., Brantford.

Victoria, B.C.

School, cost $44,200, planned by School Board. Sec., W. T. C. Pope, 1127 Catherine St. Architect, C. Elwood Watkins, 1117 Rockland St. General contractors, Stevens Bros., c/o Architect. Heating and ventilating, Andrew Sheret, 1114 Blanchard St.

Business Buildings and Industrial Plants

Brantford, Ont.

Factory contemplated by A. G. Spalding & Bros., Checopec, Mass. Manufacturers of gymnasium equipment, etc. To be built next year. Temporary quarters have been leased at 3 Dalhousie St.

Calgary, Alta.

Stores and offices, cost $500,000, for J. S. Mackie, 1st St. W. Architect, Jas. C. Teague, 310 Dominion Block. General contractors, Jones & Lyttle, Bow River and 6th St. W. Plumbing and heating, Grant Bros., 608 2nd St. E. Electrical, Cunningham Elec. Co., Thomas Block, 2nd St. W. Roof on. Work to be completed in Spring 1914.

Stores and apartments, cost $50,800, for P. O. Sullivan. Architect, J. B. Henderson, 313 Beveridge Block. General contractors and painting, McDougall & Forster, 13-14 Board of Trade Bldg. Heating and plumbing, Alberta Plumbing and Heating Co., 711 3rd Ave. Electrical, Cunningham Elec. Co., 7th Ave. W. Two storeys, 75 x 130. Roofing.

Coquitlam, B.C.

Stores and hotel, cost $50,000, for Coquitlam Terminal Co., 533 Granville St., Vancouver. Architects, Parr, MacKenzie & Day, Vancouver Block, Vancouver. General contractors, Coquitlam Constr. Co., Port Coquitlam. Two stys. and basement, pressed face brick. Excavating.

Cobalt, Ont.

Bank, cost $9,000, for Bank of Ottawa. Manager, Samuel Smythe. Architect, J. P. MacLaren, 104 Sparks Street, Ottawa. General contractors, Hill, Clark & Francis, New Liskeard. Heating, plumbing and electric lighting not let. Walls started.

Edmonton, Alta.

Re-building warehouse, cost $60,000, contemplated by Canadian Consolidated Rubber Co. Concrete foundation of building destroyed by fire will be used. Five storeys, 130 x 50, steel and brick construction, cut stone facings.

Store and offices, cost $40,000, for Capt. A. Palmer, England, c/o Architects. Architects, Magoon & MacDonald, Tegler Block. General contractors, Dunlop Construction Co., 205 Hart Block. Steel, The Manitoba Bridge and Iron Works, Ltd., Logan Ave. W., Winnipeg. Heating and plumbing, McKnight & Frost. Three storeys, 53 x 75. Walls up. To be finished about February, 1914.

Grismby, Ont.

Winery for The Pelee Island Wine & Vineyard Co. Pres., Major J. S. Hamilton, Brantford. By-law passed granting company free site and fixed assessment of $5,000 for 10 years. Contracts to be let shortly. Three storeys, 150 x 60.

Iroquois Falls, Ont.

Pulp and paper mill, cost $1,500,000, for Abitibi Pulp & Paper Co., Ltd. Sec., J. A. McAndrew, 10 Adelaide St. E., Toronto. Engineer, Henry Holgate, 9 Victoria Sq., Montreal. Wood and wet rooms ready for machinery, 175 x 60 and 250 x 130, machine shop, boiler room, also completed, 90 x 55 and 90 x 40. Daily capacity of plant 200 tons. Trimming interior.

Leamington, Ont.

Stores and hall, cost $30,000, contemplated by Leamington Masonic Lodge. Add. Sec., Masonic Lodge, 109½ Talbot St. Three storeys, white brick construction, stone trimmings, concrete and stone foundation, electric lighting, maple and concrete floors, plumbing, plate glass, store fronts and fixtures.

Medicine Hat, Alta.

Store and apartments, cost $10,000. Owner and general contractor, Jno. Gillespie. Two storeys, brick veneer construction. Excavating.

Montreal, Que.

Two stores and flats, cost $8,000. Owner and general contractor, J. A. Joly, 1205 St. Viateur. Architect, Z. Trudel, 238 St. Andre St. General contractor ready to receive tenders for roofing, plastering, painting, heating, plumbing and electrical. To be awarded about December 5th. Four storeys, 40 x 50, brick construction, hot water heating, architectural iron stairs. Foundations in.

Tenders received by Commissioners, Secretary, L. N. Senecal, until Dec. 9th, for the construction of cement floors in Bonsecours Market. Specifications, etc., at office of Superintendent of Buildings, City Hall.

Stores and flats, cost $20,000, at Outremont, for Mr. Bessette, 97 St. James St. Architect, J. A. Ouellette, 250 Amherst St. Roofing, heating and plumbing, Belisle Bros., 808 Papineau. Walls going up.

Ottawa, Ont.

Printing plant, cost $40,000, for Lowe-Martin Co., printers. Architects, Richards & Abra, 218-220 Booth Bldg. Five storeys, reinforced concrete construction.

Addition to warehouse, cost $10,000, for S. .J Major & Co., York St. Architect, C. P. Meredith, 126 Sparks St. General contractor, T. C. James, 104 Flora. Roof on.

Addition to stores, cost $50,000, for Chas. Ogilvy, Ltd., Rideau and Nicholas Sts. Architect, W. E. Noffke, Central Chambers. Three storeys, 66 x 100, concrete foundation, waterproofed, steel and solid brick construction, felt and gravel roofing, electric lighting, steam heating, birch floors, mosaic tiling, plate glass, passenger elevator, cornices, store fronts and fixtures. Plans in progress.

Alterations to bank, cost $15,000, for Bank of Montreal. Architect, C. P. Meredith, 126 Sparks St. Walls up.

Business block, cost $100,000. Owner, F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Tiling, Ottawa Tile & Mosaic Co., 130 Sparks St. Seven storeys, patent roofing, electric lighting, steam heating. Roofing.

Blacksmith shop, etc. Owners and general contractors, Campbell Steel & Iron Works, Ltd., Carling Ave. Architect, Alex. Campbell, c/o General Contractors. Steel construction, concrete foundation, corrugated iron roofing, electric lighting. Excavating.

Business block contemplated by N. D. Porter, Bank and Albert Sts. Brick veneer construction, concrete and stone foundation, felt and gravel roofing, electric lighting.

Port McNicoll, Ont.

Bank for Quebec Bank. General contractor, D. H. McInnis. Supt. of Construction, R. Patterson, Supt. of Branches, H. O., St. James St., Montreal. Interior fittings being supplied by bank. Walls up.

Prince Rupert, B.C.
Fertilizing plant for Scottish-American Oil & Fertilizing Co. Architect, J. S. D. Taylor, Bower Bldg., Vancouver. Plans prepared.

Fertilizing plant contemplated by A. S. King. Site has been purchased. To be built early next year.

Revelstoke, B.C.
Laundry contemplated by West Kootenay Steam Laundry Co., Ltd. To replace building destroyed by fire. 100 x 50, cement construction. Machinery to be installed, estimated cost $9,000.

Sarnia, Ont.
Picture theatre, cost $7,000, for Sarnia Moving Picture Theatre Co., Christina St. General contractor, F. Gutteridge. White brick construction, concrete and stone foundation, electric lighting, maple floors, plumbing, seating. Excavating.

Toronto, Ont.
Water Garth, 34 Gertrude Ave., will erect building suitable for concerts, dances, etc.

Theatre for J. Garbarino, 337 Shaw St. Mason, Elgie & Page, 18 Toronto St. Two storeys, 30 x 150, brick construction, corrugated iron, felt and gravel roofing, electric lighting, hot water heating, maple and concrete floors, lime and sand plastering, marble tiling, seating. Walls going up.

Dance hall, cost $15,000, for Prof. Davis, 215 Dundas St. Architect, E. Packer, 64 Spruce Hill Road. No contracts awarded yet. Three storeys, 35 x 48, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and birch floors, lime and sand plastering, wood and metal lath, plate glass, mantels, built in fireplaces. Plans drawn.

Stables and addition to bakery, cost $45,000, for Lawrence's Bakery, 31 Carr St. Architect, G. W. Gouinlock, 1108 Temple Bldg. Mason, Wickett Bros., 35 Deer Park Cres. Steel, Reid & Brown, Esplanade St. Tenders in for other trades but not yet awarded. Three stys., 40 x 110, brick and steel construction, felt and gravel roofing, electric lighting, concrete and birch floors, window and wire glass, galvanized iron, skylights, ventilators, metal sash, fireproof doors and shutters. Excavating.

Bank, cost $15,000, Royce and Symington, for Bank of British North America. Architects, Mitchell & White, 55 Isabella St. Plastering, Taylor & Nesbitt, 18 Havelock St. Painting, Hughes & Co., 884 Yonge St. Heating and plumbing, R. Patterson, 907 Keele St. Plastering.

Vancouver, B.C.
Alterations to "Hotel Dunsmuir" for A. Grossman, Shaughnessy Heights. Architects, Russell, Babcock & Rice, Metropolitan Bldg. Three storeys to be added to building later on. Plans being prepared.

Business building. Owner and general contractor, E. Cook, 155 Alexander St. Architect, W. M. Dodd & Co., 924 Hastings St. W. Two storeys and basement, brick construction. Plans drawn.

Re-building loft building, cost $75,000, for Kelly-Douglas & Co., Wholesale Grocers, 367 Water St. To be rebuilt at once.

Windsor, Ont.
Factory contemplated by Parsons Motor Car Co. of Canada, Ltd. Architect not yet chosen.

Stores and flats, cost $35,000, for A. St. Dennis, 155 London St. W. Architects, Atchison & Adams. Two storeys, 70 x 110. Roofing.

Store and flat, cost $10,000, for Nathan Cohn. Architects, Atchison & Adams. Mason and plastering, Shulman & Kaplowitz. Carpenters, Berch & Appleman. Heating and plumbing, Robt. Paddon. Electrical, E. Darrow. Two storeys, 38 x 60. Excavating.

Winnipeg, Man.
Office building for Merchants Bank of Canada. Architects, J. D. Atcheson & Co., Trust & Loan Bldg. General contractors, G. A. Fuller & Co., Union Bank Bldg. Roofed.

Stores and offices for D. S. Curry, care architects, J. D. Atcheson & Co., Trust & Loan Bldg. Five storeys, Plans in progress.

Addition to warehouse, cost $35,000, at St. Boniface, for Western Canada Flour Mills, Winnipeg. Architects and general contractors, G. H. Archibald & Co., 827 Union Bank Bldg. Roof on.

Re-building malt house, cost $18,000. Owners and general contractors, Canadian Malting Co., Lincoln St. One sty., brick construction, felt and gravel roofing, electric lighting, steam heating, pine floors. Plans drawn.

CONTRACTS AWARDED

Calgary, Alta.
Theatre, store and office, cost $85,000, for Dr. T. H. Blow, 210 7th Ave. W. Plastering done by day labor. Heating, Davidson Bros., 1231a 9th Ave. E. Plumbing, Campbell & Hillier, 1007 17th Ave. W. Electrical, Gracey & Crane, Ltd., 129 5th Ave. E.

Grand Forks, B.C.
Cannery, cost $11,000, for Grand Forks Cannery Co. Pres., Daniel McKimmon. Sec.-Treas., J. A. McCallum. General contractor, Angus McDougall. Two stys. and basement, 125 x 50, cement or brick construction, concrete foundation.

Halifax, N.S.
Store and warehouse, cost $20,000. Owners, C. Brister & Son, Ltd., 57 Upper Water St. General contractor and builder, Robert Daw, 536 Gottingen St. Four storeys, 70 x 103, concrete foundation, waterproofed, reinforced concrete construction, felt and gravel roofing, electric lighting.

Hamilton, Ont.
Branch bank, cost $12,000, for Metropolitan Bank. Architects, Watt & Blackwell, 125 Lister Chmbrs. General contractor, R. A. Campbell, 117 Duke St.

Stores and hall, cost $25,000, for Royal Templars of Temperance, Spectator Bldg. Architect, W. A. Edwards, 7 Hughson St. S. Roofing, M. V. Maclean, 314 Hess St. S. Plastering, Hannaford Bros., 232 Robinson St. Gas heating, Canadian Rector Gas Heating Co., Lister Chmbrs. Plumbing, W. J. Walsh, 210 King St. E. Sewer, J. D. Armstrong, 138 Erie Ave. Three storeys, steel and brick construction, gas heating.

London, Ont.
Store, cost $12,000, for S. E. Burridge, 99 King St. General contractors, Hyatt Bros., Egerton St., London. Two stys., 50 x 80, brick construction, concrete foundation.

Montreal, Que.
Addition to store and ice cream parlor, cost $15,000, for Geo. Nicholls & Co., 332 St. Catherine W. Architect, D. J. Crighton, Jacobs Bldg. General contractor, Mr. Clarke, c/o Owners. Heating and plumbing, W. Mackenzie, 87 Mansfield. Three storeys.

Ottawa, Ont.
Business blcok, cost $15,000, for Blackburn Bros. Architect, W. E. Noffke, Central Chmbrs. Painting, J. Duford-Lea, Rideau St. Heating and plumbing, J. T. Blythe, Bank and James. Eight storeys, electric lighting, steam heating.

Regina, Sask.
Stables, cost $23,900, planned by City Council (Dr. M. R. Bow, M.H.O.). Architect, R. W. Allen, City Engineer's Office. General contractors, Minkley & Traud. Contract for cornices, gutters, tanks and tinware awarded to Hastings and Willoughby, 1719 Cornwall St.

Steveston, B.C.
Cold storage plant for B. C. Packers' Association, 517 Granville St., Vancouver. General contractors, The B. C. Granitoid Co., Exchange Bldg., Vancouver. Sub-structure, Peterson and Archibald, 1905 Quebec St., Vancouver. Sub-contractors are in the market for 1,050 piles. Work to start at once.

Toronto, Ont.
Factory, cost $25,000, for Lever Bros., Eastern Ave. Architect, G. W. Gouinlock, Temple Bldg. Mason, Wickett Bros., 35 Deer Park Cres. Two storeys, 35 x 118, brick and steel construction.

Victoria, B.C.
Building, cost $20,000, for B. C. Pottery Co., Ltd., 626 Pandora. General manager, A. T. Monteith. Architects, Geysbeek Engineering Co. Consulting Architect, T. D. Sedger, 512 Bastion. General contractors, Chas. W. Carkeek & Co., 618 Sayward Bulg. Three stys., mill construction.

Store and residence, cost $8,000, for H. W. Walker, 70 Esquimalt Rd. Architect, T. D. Sedger, 512 Bastion. General contractor, William Martin, 2944 Bridge St.

Residences

Hamilton, Ont.
Five residences, cost $12,500. Owner and general contractor, J. H. Somerville, 28 Prospect St. 2½ storeys, brick construction, concrete and stone foundation, shingle roofing, gas and electric lighting, hot air heating, pine floors, lime and sand plastering, mantels, plumbing. Excavating.

London, Ont.
Apartment house, cost $16,000, is contemplated by Hugh M. Douglas, 206 Central Ave. Architects, Watt & Blackwell, Bank of Toronto Bldg. Two storeys, 40 x 74, tapestry brick construction, concrete foundation, felt and gravel roofing,

gas and electric lighting, oak and maple floors, plumbing, lime and sand plastering, plate glass, cornices, fire escapes, built in fireplaces, mantels, telephone and annunciator system, architectural iron stairs.

Montreal, Que.

Four flats, cost $12,000, for Thos. Hannah, Youville. General contractors, R. E. Edward & Son, 212 Versailles. General Contractors ready to receive tenders for roofing, heating and plumbing. Electrical, Bonet & Thompson, c/o General contractors. Two storeys, 50 x 70, felt and gravel roofing. Foundations in.

Two flats, cost $5,000. Owner and general contractor, Henry Gaffney, 204 St. James. General Contractor ready to receive tenders for plastering and painting. Two storeys, 25 x 52, stone and brick foundation, felt and gravel roofing, hot water heating. Excavating.

Three flats, cost $9,000. Owner and general contractor, Henry Gaffney, 204 St. James. General contractor ready to receive tenders for plastering and painting. One storey, 36 x 36, stone and concrete foundation, felt and gravel roofing, hot water heating. Excavating.

Ten cottages, cost $40,000, at Cote St. Michael. Architect, S. Frappier, 2238 Park Ave. Plans drawn. Architect will call tenders about Dec. 1st. Frame construction.

16 flats, cost $12,000. Owner and general contractor, J. H. Mercure, 1124 Rachel E. Work done by day labor. Four buildings, 3 storeys, 50 x 40 pair, concrete foundation, felt and gravel roofing. Foundations in.

Residence, cost $23,000, at Westmount, for J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. Tenders close with Architect for roofing and plastering about Dec. 1st.

12 flats, cost $8,000, Messier. Owner and general contractor, A. Martel, 631 Frontenac. Work done by day labor. Three storeys, 66 x 50, concrete foundation, felt and gravel roofing. Excavating to start.

Residences, cost $7,000, at Outremont. Owner, builder and general contractor, W. Ouimet, 1911 Esplanade. General contractor ready to receive tenders for plastering. Three storeys, 25 x 72, concrete foundation, felt and gravel roofing, electric lighting, hot water heating. Excavating.

Cottages, cost $16,000, at Westmount. Owners and general contractors, White Constr. Co., 306 Coronation Bldg., St. Catherine W. Owners will call tenders on some trades shortly.

Six flats, cost $8,000. Owner, mason and carpenter, A. & D. Boileau, 343 De Lanaudiere. Architect, Jos. Lavigne, Work done by day labor. Three storeys, 44 x 66, concrete foundation, felt and gravel roofing. Excavating.

Three flats, cost $5,000. Owner and general contractor, Jos. Frenette 363 Garnier. Work done by day labor. Three storeys, 25 x 62, concrete foundation, felt and gravel roofing. Foundations in.

Montreal West, Que.

Residence, cost $11,200, for J. R. Colby, c/o Architects, Peden & McLaren, 20 St. Alexis St. General contractor and painting, J. J. Kirkpatrick, Montreal W. Plastering.

Oak Bay, B.C.

Residence, cost $8,000, for Mr. Colgate, c/o Architect, Jesse M. Warren, 503 Central Bldg., Victoria. Eight rooms, hardwood floors, electric lighting, plumbing. Plans being prepared.

Ottawa, Ont.

Residence, cost $6,600, for S. J. Willoughby, 101 James St. Architect, general contractor, mason and carpenter, R. E. McKinstrey, 91 2nd Ave. Plastering, painting, heating, plumbing and electrical not let yet. Brick veneer construction. Foundations in.

Residence, cost $6,000. Owner, J. C. Reynolds, 117 Henderson. General contractor, masonry, brick and roofing, R. W. Hamilton, 81 Echo. Other contracts not let yet. Double brick veneer construction. Foundations in.

Residence, cost $5,500. Owner and carpenter, Geo. Wilson, 341 Gloucester St. Masonry and brick, Mr. Weatherston, at job. Other trades not yet called for. 2½ storeys, 34 x 46. Foundations in.

Residence, cost $7,500. Owner, general contractor, mason and carpenter, A. E. Shaver, 45 Powell Ave. Other contracts not let yet. 2½ storeys, 38 x 32, brick veneer and roughcast construction. Foundations in.

Residence, cost $18,000, for W. F. Powell, 570 Sussex. Architect, W. E. Noffke, Central Chmbrs. Tiling, etc., A. K. Mills & Sons, 191 Sparks. 2½ storeys, electric lighting, hot water heating. Roofed.

Residence, cost $7,000. Owner, architect, general contractor, mason and carpenter, A. E. Shaver, 45 Powell Ave. Other contracts not let yet. Brick veneer and roughcast construction. Foundations in.

Residence, cost $6,000. Owner, general contractor and carpenter, P. W. Joyce, 126 Spadina Ave. Masonry not let. Tenders to be called later for plastering, painting, heating and electrical. Stone foundation, brick veneer construction, shingle roofing, electric lighting, hot air heating, birch and spruce floors, water heaters, mantels, built in fireplaces. Excavating completed.

Residence, cost $15,000, for A. E. Blount, 26 Russell. Architect, W. E. Noffke, Central Chmbrs. General contractor, A. E. Spooner, Windsor House. Painting, Geo. Cundell, 58 Hastey. Heating and plumbing, J. T. Blythe, Bank and James. 2½-storeys, shingle roofing, electric lighting, hot water heating, oak, birch and spruce floors, water heaters, plate glass, mantels, built in fireplaces. Walls up.

Regina, Sask.

Thirty residences at Eastview Sub-division are contemplated by J. K. McInnes, care Regina Standard, Rose St. Work to start in spring.

Apartment building, cots $30,000, for A. M. Fields, c/o W. A. Burns, New Dallas Block. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg. Tenders received by Architects until Nov. 31st for excavation. Five storeys.

Toronto, Ont.

Two residences, cost $5,000. Owner, general contractor, mason and carpenter, A. Rotstein, 55 Oxford St. Tenders wanted for plastering, painting and concrete cellars and walks. 2½-storeys, 30 x 36, brick construction and foundation, shingle, felt and gravel roofing, gas lighting, hot air heating, birch and concrete floors, lime and sand plastering, wood lath.

Apartment, cost $8,000. Owner and general contractor, D. Goodheim, 316 Bathurst St. Architect, J. H. Galloway, 23 Toronto St. Three storeys, 44 x 62, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak, birch and pine floors, lime and sand plastering, wood lath. Built-in fireplaces, mantels. Plans drawn.

One detached residence, cost $7,000, for L. A. Docherty, 332 Russell Hill Rd. Work not started yet. 2½ storeys, 24 x 36, brick and steel construction, brick foundation, slate roofing, gas and electric lighting, hot water heating, oak, birch and pine floors, lime and sand plastering, wood lath, marble tiling, leaded glass, built-in fireplaces, mantels.

Two pair residences, cost $8,000. Owner and general contractor, A. E. Cudmore, 111 Ivy Ave. Owner will superintend. Two storeys, 33 x 42, pair, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Three attached residences, cost $8,000. Owner and general contractor, C. Pain, 275 Dupont St. 2½-storeys, 48 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, pine and oak floors, lime and sand plastering, wood lath, mantels, built in fireplaces, hot air heating. Plans drawn.

One pair residences, cost $5,500. Owner and general contractor, W. G. Robinson, 835 Gerrard St. 2½-storeys, 36 x 44, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

One detached residence, cost $5,000. Owner and general contractor, T. Palmer, 44 Briar Hill Ave. Will sublet some trades. 2½-storeys, 24 x 32, brick construction and foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, marble tiling, leaded glass, built in fireplaces, mantels. Plans drawn.

Two pair residences, cost $8,500. Owners and general contractors, Agnew Bros., 203 Withrow Ave. Owners will superintend construction. 2½-storeys, 3 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Excavating.

Three pairs residences, cost $12,000, for E. A. Wills, 568 Dovercourt Rd. Owner will superintend construction and will let some trades. Two storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood

(Continued on page 69)

Tenders and For Sale Department

TENDERS

FOR

A Complete Mechanical Filtration Plant, Boilers, Steam Turbo-Generator Plant, and all Appurtenances

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, January 20th, 1914**, for the installation of a complete Mechanical Filtration Plant, Boilers, Steam Turbo-generator Plant, and all appurtenances at Toronto Island.

Specifications and tender forms may be obtained upon application at the office of Mr. James Milne. Mechanical and Electrical Engineer, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or, in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
November 25th, 1913. 49-51

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharfs and Dredging at Rimouski, Que.," will be received at this office until 4 p.m., on **Monday, December 22, 1913,** for the construction of a line of Wharfs and Dredging Tidal Basin at Rimouski, County of Rimouski, Que.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Rimouski, Que.; Post Office Building, Quebec; Post Office, St. James St., Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43493. 49-50

SALES MANAGER

District Sales Manager wanted by an established Consulting Engineering & Construction Corporation, based on co-operative plan. Offices in Cleveland, Detroit, Buffalo and New York City. The position requires a man with engineering knowledge, one who can take full charge of the Sales Department. Highest references and $1,000 investment required. Contract with salary, commission and expenses guaranteed. Answer Box 919, Contract Record, Toronto. 49

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Hanover, Ont.," will be received at this office until 4 p.m. on **Monday, December 22, 1913**, for the construction of a Public Building at Hanover, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Hanover, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 28,1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47226. 49-50

Contractor with Steam Shovel, Cars, Track, Horses, Scrapers, etc., would like to hear from parties having railroad grading or other work to let. Address "Contractor," c/o Contract Record, Toronto. F

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday Noon, December 12th, 1913

for

Heating, Howard School

and

Plumbing, Heating, Electric Wiring, and Heat Control, Regal Road School

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, on and after Thursday, December 4th. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART,
Chairman of Committee.

W. C. WILKINSON,
49 Secretary-Treasurer.

Wanted Employees

WANTED—Electrical man with knowledge of gasoline engines to sell and erect small isolated electric light installations. Good opportunity for young man. Reply giving age, experience and salary required, to Box 916, Contract Record, Toronto. 49-50

Toronto Harbor

Equipment Wanted

We are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on our work in

PROPOSALS WANTED

from

Experienced Contractors

for

Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to

CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

48-49

WANTED

A 3 to 5 ton double drum Hoisting Engine with swinger and boiler complete.

Also a 3 to 5 ton timber stiff leg derrick.

Sun Brick Co., Limited,
1023 Traders Bank Building,
48-49 **Toronto, Ontario**

Residences

(Continued from page 67)

lath, mantels, built in fireplaces. Plans drawn.

Two pair residences, cost $8,000. Owner and general contractor, E. Taylor, 162 Delaware Ave. 2½-storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Plans drawn.

Vancouver, B.C.
Residence, cost $400,000. Owner, B. T. Rogers, c/o B. C. Sugar Refinery Co. Ltd., 997 Powell St. Architects, Somervell & Putman, London Bldg. Fireproof construction. Plans to be prepared.

Westboro, Ont.
Residence, cost $6,000, for J. E. Caldwell, City View. Architect, C. P. Meredith, 126 Sparks St., Ottawa. Plastering.

Windsor, Ont.
Two-family flat, cost $7,500, for Peter Osterhou. Architects, Leybourne & Whitney. Work to be done by Owner. Two storeys, 39 x 44, frame and stucco construction, concrete foundation, shingle roofing, electric lighting, hot air heating, oak floors, water heaters, stucco, lime and sand and hard wall plastering, wood lath, iron stairs and railings, built in fireplaces, laundry tubs. Plans drawn.

Two-family flat, cost $6,000, for Owner, A. A. Little. Architects, Leybourne & Whitney. Work to be done by Owner. Two storeys, 42 x 38, brick and stucco construction, concrete foundation, shingle roofing, electric lighting, hot air heating, oak floors, water heaters, stucco, lime and sand and hard wall plastering, built in fireplaces. Plans drawn.

Winnipeg, Man.
Two residences, cost $8,000. Owner and general contractor, R. Robson, 284 Simcoe. Two storeys, 25 x 28, frame construction, stone foundation, shingle roofing, electric lighting, maple floors. Excavating.

Four residences, cost $10,800. Owner and general contractor, J. W. Phillipson, Suite 44, Aikins Block. Two storeys, 20 x 26, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

CONTRACTS AWARDED

Halifax, N.S.
Residence, cost $5,500, for A. G. Cross, 12 South Hollis St. Builders and general contractors, Maxner & Dunlop, 152 Windsor St. Two storeys, 24 x 31, cement foundation, frame construction, felt and gravel roofing, electric lighting.

Montreal, Que.
Residences, cost $12,000, at Outremont, for Mrs. E. N. Blackburn, 1194 St. Andre. General contractor, E. Charbonneau, 1813 Clarke. Three storeys, 50 x 70, stone foundation, brick construction, felt and gravel roofing, electric lighting, hot water heating.

Six flats, cost $6,500, for Estate Ed. D. Roy, 490 Parc Lafontaine. General contractor, Mag. Ouimet, 20 Christopher Columbus. Three storeys, 43 x 40, concrete foundation, felt and gravel roofing.

Ottawa, Ont.
Residence, cost $5,000. Owner and architect, Ainslee W. Green, Trust Bldg., Sparks Street. General contractor, R. A. Kemp, 149 1st ave. Double brick veneer contsruction, stone foundation, shingle roofing, electric lighting, hot air heating, birch and pine floors, water heating.

Residence, cost $10,000. Owner and general contractor, W. E. Noffke, Central Chambers. Painting, Geo. Cundell, 58 Hastey Ave. Heating and plumbing, J. T. Blythe, Bank and James.

Residence, cost $10,000, for Dr. Quinn, c/o Architect, F. C. Sullivan, Castle Bldg., Queen St. General contractor, T. A. Shore, 41 Chamberlain. Painting, W. J. Carson, 293 Laurier W. Heating and plumbing, Holloway & Son, 373 Somerset. Electrical, Marchand & Donnelly, 128½ Sparks.

Residence and garage, cost $15,000. Owner and architect, W. E. Noffke, Central Chambers. Mason, Holbrook & Sons, 425 Somerset. Carpenter, Smith Bros., 140 Flora St. Steel, Dom. Bridge Co., Sparks St. Plastering, heating, plumbing and electrical not let. 2½-storeys, stone and concrete foundation, brick veneer construction.

Sussex, N.B.
Residence, cost $7,500, for Garfield White, Sussex. Architect, F. Neil Brodie, 42 Princess Street, St. John. Heating and plumbing, Carling & Regan, Princess Street, St. John.

Toronto, Ont.
Apartments, cost $9,000, for B. A. Cumpston, c/o Architects, S. B. Coon & Son, 512 Temple Bldg. Mason, J. W. Hewitt, 56 Roncesvalles Ave. Carpenter, J. M. Davis & Son, 49 Muir Ave. Iron and heating, A. Welch & Son, Queen W. Plastering, W. Haney, 193 Degrassi St. Painting and glazing, C. W. Landon, 569 College St. Electric wire, E. L. Norrish, 82 Clinton St. Two storeys, 36 x 56.

Vancouver, B.C.
Residence, cost $35,000, for H. Bingham, 2063 Grant St. Architect, G. B. Kauffman, Davis Chambers. General contractors, Hodgson, King & McPhalen Bros., 319 Pender St. W. Concrete hollow tile, semi-fireproof and brick construction.

Power Plants, Electricity and Telephones

Beausejour, Man.
Electric light system, cost $3,000, planned by Town Council. Sec.-Treas., M. J. Hoban. By-law passed.

Hamilton, Ont.
Hydro extensions contemplated by Board of Control. Mayor, Jno. Allan. By-law to raise $1,335,000 to be submitted in January.

Point Grey, B.C.
Street lights contemplated by Municipal Council. Clerk, G. G. Heighway, Kerrisdale. 20 additional lights to be installed.

Nelson, B.C.
Street railway improvements, cost $10,000, by-law to be submitted by Town Coun. Clerk, W. E. Wasson.

Walkerville, Ont.
Distributing station, cost $40,000, planned by Hydro-electric Power Commsn., Toronto. General contractors, mason and carpenters, H. G. Christman Co., Hamilton, Ont. Roofing, painting, heating and plumbing not let. Two storeys, 73 x 125, steel, reinforced concrete and brick construction.

CONTRACTS AWARDED

Regina, Sask.
Pawer house equipment planned by City Council (Light and Power Dept.). Supt., E. W. Bull. General contractors, Williams, Robinson & Co., Rugby, Eng., for one 3,000 kw. steam turbine with condenser, and Whitney Foundry & Equipment Co., Harvey, Ill., for one 25 ton capacity, hand power crane for 45 ft. span.

Miscellaneous

Iroquois Falls, Ont.
Contemplated purchase of hotel furnishings by Abitibi Pulp & Paper Co. General contractor, Robt. Chapman, Porcupine. Three storeys, 35 x 70, 50 rooms.

London, Ont.
W. Metcalf, c/o Metcalf Agencies, 252 Dundas St. (manufacturer of rope-making machines), is in the market for special cast iron, malleable iron and general castings.

Montreal, Que.
New system of clocks for Board of Commrs. Sec., L. N. Senecal. Tenders received by Board of Commrs. until noon Dec. 18th for the supply and installation of an Electric Primary Self-Winding Clock System, in the City Hall Annex. Specifications, etc., at office of Purchasing & Sales Agent, City Hall.

Orillia, Ont.
Monument of Champlain to be erected in Couchiching Beach Park in August, 1915, cost $20,000. Competition open to British and French subjects. First prize $500.

Ottawa, Ont.
Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston, Ottawa. Tenders received by Alex. Johnston until Jan 8, 1914. Plans, etc., at offices of Purchasing and Contract Agent at Dept., Ottawa, Collectors of Customs, Toronto, Collingwood, Port Arthur, and at agencies of above Dept., at Montreal, St. John, N.B., Halifax, N.S., and Victoria, B.C. Steel twin screw ice breaking steamer, length B.P. 275 ft.; breadth, extreme, 57 ft. 6 in.; draft, mean, 19 ft.; indicated h.p. 8,000. To be delivered at Quebec.

Parry Sound, Ont.
Conger Lumber Co. are open for quo-

tations on about 25,000 red brick, to reline burner at saw mill in March, 1914.

Port Lambton, Ont.
Machinery required by Mr. C. A. Sharp who is in charge of Canadian plant for manufacture of drain heads for owners, American Drainage Co., Dubuque, Iowa.

Stratford, Ont.
Fire apparatus required by City Council. Mayor, C. N. Greenwood. Apparatus will be purchased, some each year, out of general funds.

St. Hyacinthe, Que.
Cedar telegraph posts required by City Council. Clerk, A. Messier. Tenders to be called December 19th for five posts, 40 ft. long, to be at least 9-in. at small end and balance of carload 35 ft. long and 8-in. at small end.

South Vancouver, B.C.
Municipal Council. Clerk, Mr. Springford, Fraser & Wilson Road. Electrical Engineer Rawder has submitted two sets of plans, one for police alarm system of 25 boxes, estimated cost $10,000, the other for 50 box alarm system.

Tillsonburg, Ont.
Messrs. Magee & Jackson, Architects, Rolph St., wish catalogues and samples of building materials.

Toronto, Ont.
Travelling crane required by Board of Control. Mayor, H. C. Hocken. Tenders close Dec. 16th. Plans, etc., at Rm. 12, City Hall. One overhead hand operated traveling crane, working load 40,000 lbs., for Main Pumping Station.

Sun Brick Co. require one 40 h.p. boiler; 1 double drum engine with swinger attachment; one stiff leg, 5-ton derrick with 40 ft. boom, second-hand preferred. Information from Mr. Walker, Don Valley Works.

Complete mechanical filtration plant, boilers, steam turbo-generator plant and appurtenances for Toronto Island. Board of Control. Mayor, H. C. Hocken. Tenders close Jan. 20. Plans, etc., at office of Works Dept.

The Management Committee of Board of Education will recommend that individual lockers be provided for each pupil. Sec., W. C. Wilkinson.

Vancouver, B.C.
Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until 4 p.m. Dec. 3rd, for interior fittings for Customs Examining Warehouse. Plans, etc., at offices of A. J. Chisholm, caretaker, Public Bldg., Vancouver, W. Henderson, Residential Architect, Victoria, and at Dept., Ottawa.

Winnipeg, Man.
Steam locomotive with separate tender and snow plow for use on City's Tramway between Point du Bois and Lac du Bonnet. Specifications at office of Engineer, J. G. Glassco, 54 King St.

Business Notes

Beamsville, Ont.
Residence of Horace Whitton destroyed by fire. Loss $4,000, covered by insurance.

Brighton, Ont.
Hotel stables occupied by A. A. Wode, proprietor of Hotel Central, destroyed by fire. Loss about $5,000.

Cumberland, B.C.
Saw mill of Canadian Collieries (Dunsmuir) Ltd. 2,000,000 ft. lumber destroyed by fire, also valuable machinery. To be rebuilt at once.

Edmonton, Alta.
Warehouse of H. W. McKinney, M.P.P., destroyed by fire. Tenants, L. O. Rose & Co., tobacco, etc.; A. N. Moyer & Co., school furnishings; Otis Fensom Elevator Co.; National Drug Co. Loss about $45,000.

Ganges Harbor, B.C.
Hotel Ganges destroyed by fire. Loss $15,000, covered by insurance. To be rebuilt at once.

Montreal, Que.
Store of M. Wolfe, 462 St. Catherine W., destroyed by fire. Loss $7,000.

Electrical store of F. Nichols & Co., 119 Bleury St., destroyed by fire. Loss $8,000.

Pincher Creek, Alta.
Stores, etc., destroyed by fire. Hudson's Bay Co., Loss, buildings, $9,000, stock $3,000, insurance $30,000; Dr. Hewitson, residence, $3,500, insurance $2,000; F. S. Blake, building $2,000, insurance $1,500; Langton's livery and barn, loss $5,000, insurance $3,000; I. X. L. Blacksmith Co., building $4,000, insurance $2,000.

Yarker, Ont.
General store of D. B. Bowman destroyed by fire. Some insurance.

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For road preservation. Applied hot or cold, it forms a protective coating for road surfaces. Having the stability of the lake asphalt, it should not be confused with ephemeral dust preventives. Trinidad Liquid Asphalt is a permanent constructive agent; it *stays in the road*, and builds up a lasting asphaltic surface. Send for Booklets.

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Representing the Lumbering and Woodworking interests of British Columbia Alberta Saskatchewan and Manitoba
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would result in additional competition, which might save your city or town or your client many hundreds of dollars.

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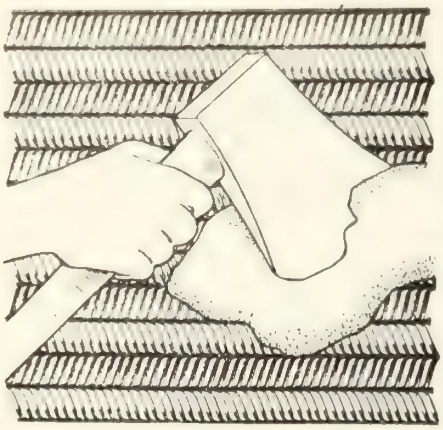
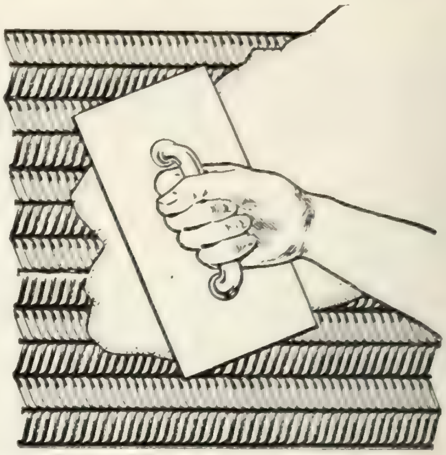
A. Angstrom - Montreal Representative - 509 Canadian Express Building

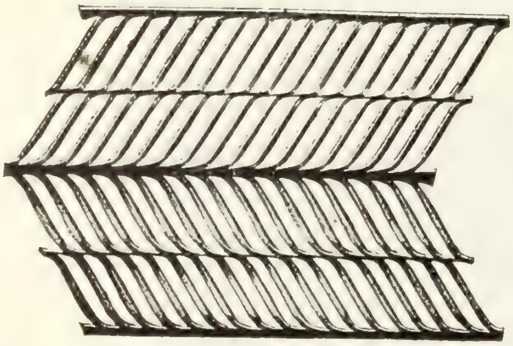


Who will cover the most lath, the man with the axe, or the man with the trowel?



The plasterer uses a trowel because it presents a flat surface on the mortar and spreads it.

HERRINGBONE LATH



and the trowel work together, which permits first class work to be done with great speed. The diagonal strands of HERRINGBONE LATH present a flat surface to the mortar spreading it instead of cutting it.
The extreme rigidity of HERRINGBONE LATH permits the lather to erect at least 10 per cent. more lath than is possible when using other makes. This rigidity also affords a firmer plastering surface than any other make of lath.
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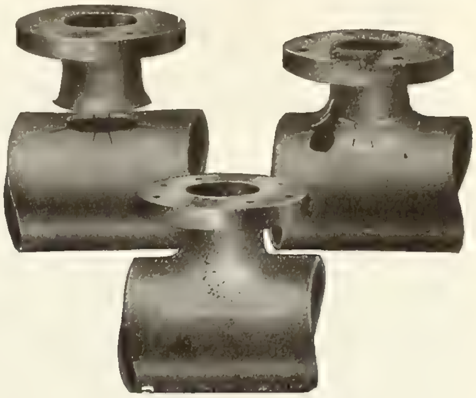
File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario



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IN this product you get a brick of such superior quality that a saving of one dollar a thousand can be effected in the laying of the bricks as compared with ordinary irregular brick.

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Special Features

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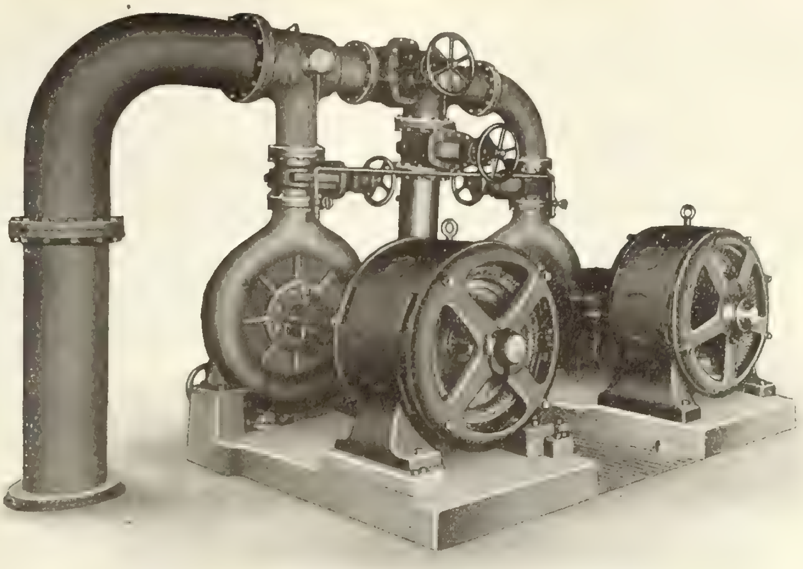

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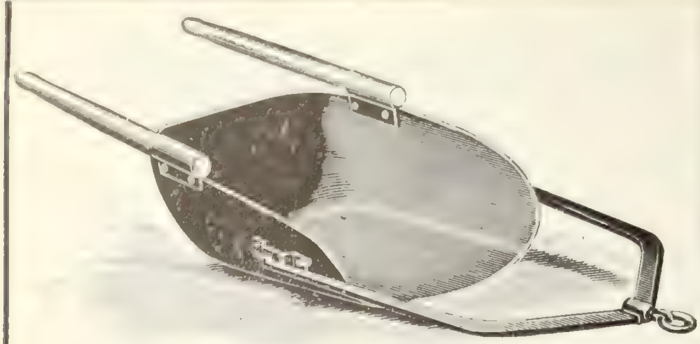

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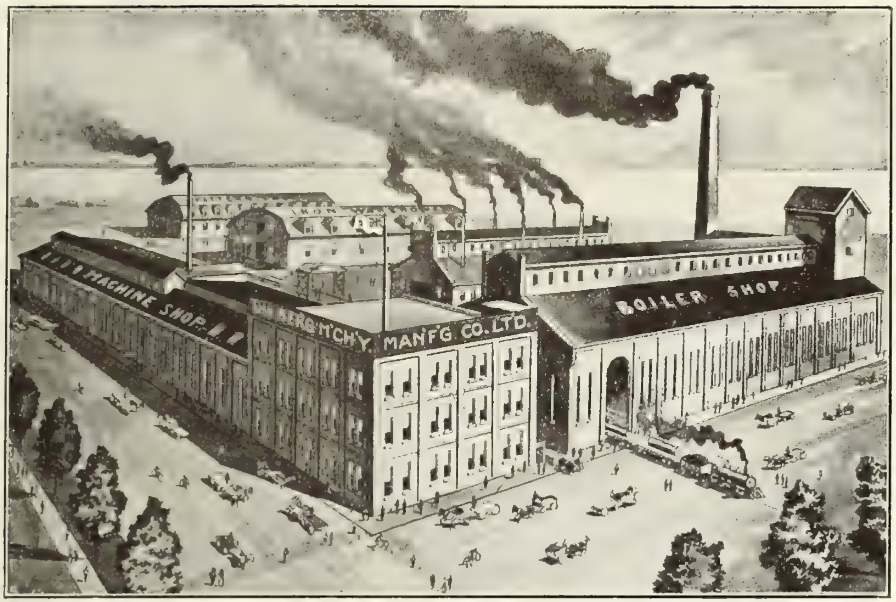

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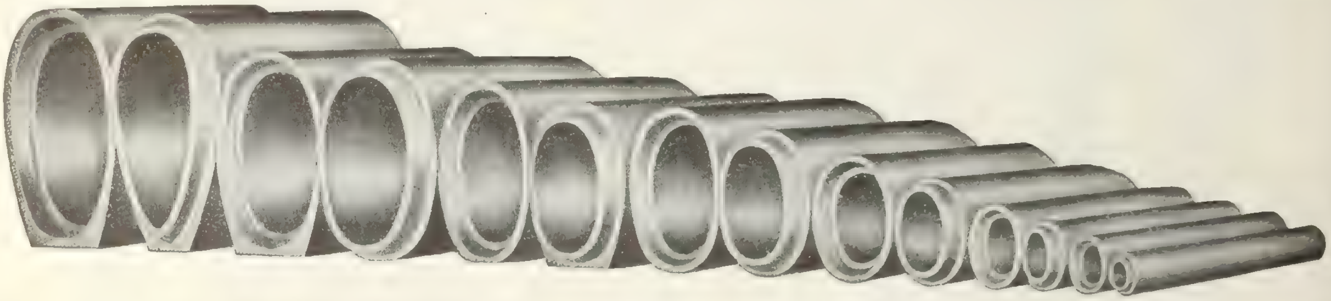

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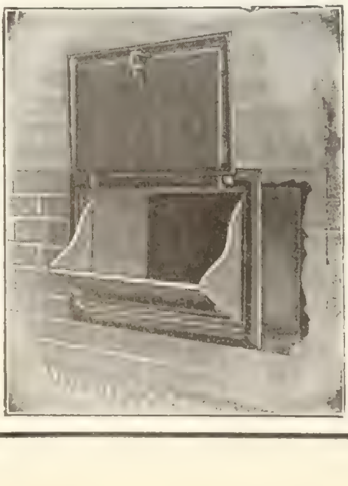

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar.. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

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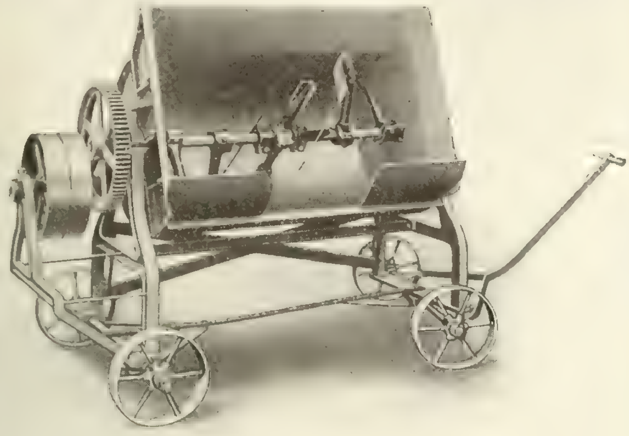

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For combination shop and outside use this Hand Truck Mixer is acknowledged to be the very best on the market. It has been used on hundreds of sidewalks and foundation contracts with unqualified success. It is strongly built and so simple in design that it will never give any trouble with repairs.

Strongly Made—Well Balanced **Easy to fill—Easy to Dump**

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"Hayes" Patent Lath

in steel, overcomes certain objections to expanded and other types of metal lathing, as it has extraordinary stiffness and strength, and gives a perfect bond for plaster. It maintains plaster positively under fire and water, and is itself a barrier to fire. For plaster work or backing tile, and for the best fireproof construction, with easy application to walls and ceilings, our "Hayes" Patent Steel Lath stands alone.

It will pay you to learn all about "Hayes" Patent Steel Lath, made on our modern machines. It makes economical and easy construction, using lime or cement plaster.

THE METALLIC ROOFING CO.
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TORONTO AND WINNIPEG

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Made in Two Sizes

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8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

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International Marine Signal Co. Limited
Ottawa, Canada

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1, 10 x 16 Slidevalve Engine
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1, 10 Ton Derrick Complete
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1, 40 H. P. Bullock Motor
2, 2 H. P. 2 Phase Motors
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1, 6″ Morris Sand Pump Steam Connected
1, 7 x 12 Beatty Hoist with Swinger
1, No. 4 Champion Stone Crusher
1, 6 x 3 x 7 Cameron Sinker
1, Buckeye Trench Excavator

The above machines are but slightly used and are in good working order.

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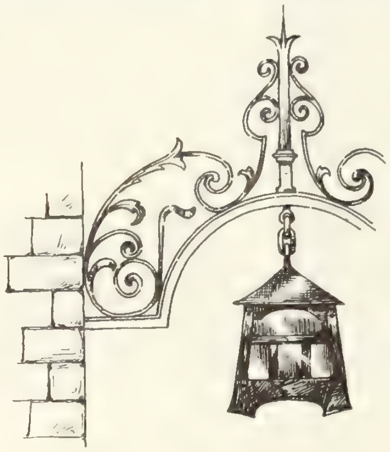

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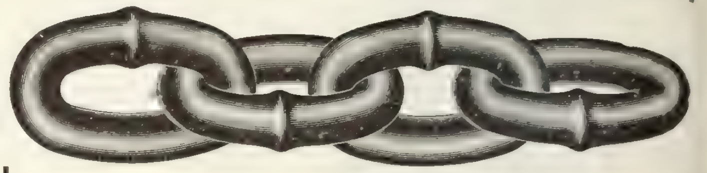

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25% More Weld = 25% More Wear

Sizes 3/16″ to 3/4″ inclusive.

The only welded chain made in Canada

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Absolutely the best in the city.
Daily capacity of plant: 40,000.
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Free from bats and culls.
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Canadian Made Steel Dump Cars

Simplest, Strongest, Best

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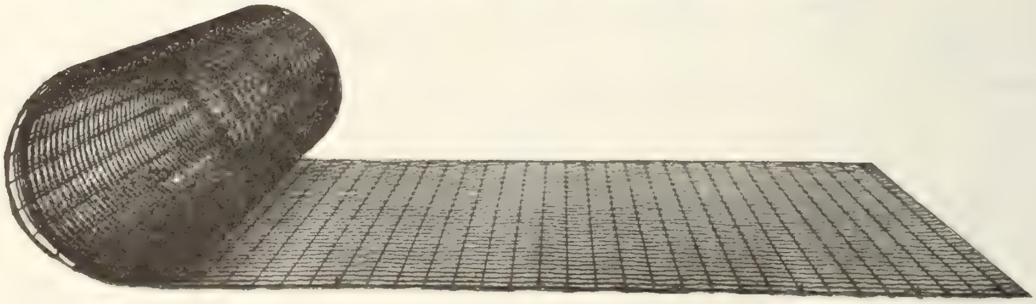

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The B. Greening Wire Co., Limited

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Towers and Tanks for all purposes.

Concrete Mixers

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Water supply outfits of every description.

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THIS CAR LOADED WITH
BAY STATE BRICK - CEMENT COATING
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WAITE FULLERTON CO LIMITED
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WADSWORTH HOWLAND & CO INC

A Carload of

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Thousands and thousands of gallons of this coating are being used as a protection for cement, brick and stucco in the Canadian Northwest.

It insures concrete, cement and stucco against disintegration from moisture and does not destroy the pleasing effect of concrete.

It is used in mills, hotels, residences, railroad construction, or bridges, or wherever concrete, cement or stucco is employed.

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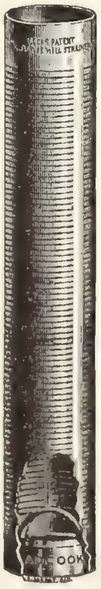

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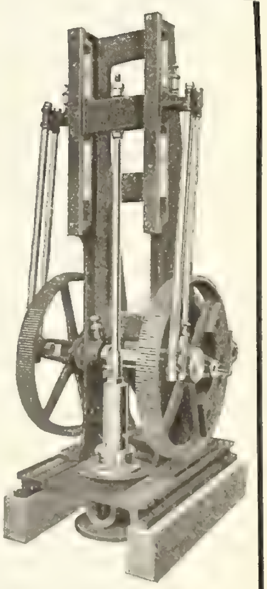
Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.



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WATER WORKS CONTRACTORS

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For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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Bridges—Steel Buildings
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Estimates Furnished Promptly

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Are You Aware That

GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

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Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

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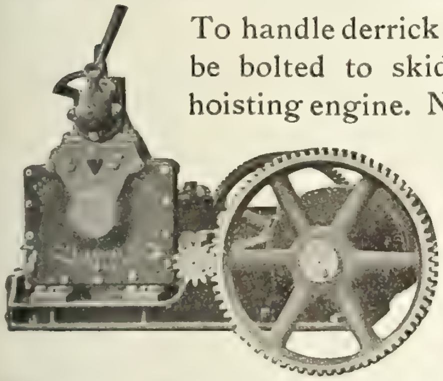
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The Dake Swinging Gear



To handle derrick booms. Can be bolted to skids in front of hoisting engine. No dead center.

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"Queenston Blue" Limestone

Send us your specifications for Cut Stone work

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for Interior Construction

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every size for Water, Gas, Culvert or Sewer, Carried in Stock

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THIS IS THE THIRD OF A SERIES OF DISCUSSIONS OF SIX VITAL POINTS DETERMINING THE SELECTION OF AN

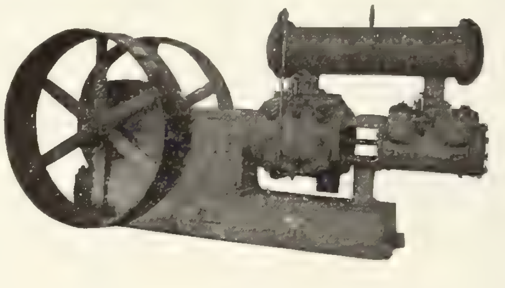
AIR COMPRESSOR

YOU WANT THE COMPRESSOR THAT DELIVERS THE MOST AIR WITH THE LEAST POWER.

POWER ECONOMY

Much or little power is needed to compress air, according to the experience of the compressor designers and the skill of the builder. The best built machine, because it minimizes waste, is the most economical of Power.

Our Class "NE" and "NF" Compressors owe their splendid efficiency to the fact that they are designed and built by engineers who have been making air compressors of all descriptions for forty-one years.



Class "NE-2" Two Stage, Belt Driven Compressor with Efficient, Overhead, Water-Tube Intercooler

Consider the sources of loss in an air compressor and the means by which these losses may be reduced.

First, Mechanical Friction—it can be minimized only by a structure so rigid as to resist all cramping, binding stresses; by bearing surfaces large and bearing pressures moderate; and by ample and effective lubrication.

Class "NE" and "NF" Compressors are exceptionally strong and rigid; their bearings of generous proportions; and automatic "bath" lubrication floods every bearing with oil. This means the highest mechanical efficiency.

Second, Losses of Compression—here economy lies in very large inlet and discharge ports and passages, and thorough cooling of the air end.

In "NE" and "NF" Compressors, the ports and passages have been increased beyond all precedent. The splendid valve movements make these large areas fully effective. The air cylinder is completely jacketed on heads and barrel. This means the highest single stage compression efficiency. In two stage machines employment is made of an efficient intercooler giving compression efficiency equal to large expensive duplex construction.

Third, Regulation Efficiency—using power economically under changing load.

The regulating devices on "NE" and "NF" economically and automatically adjust power to load, within the limits of this type of machine. This means efficient and reliable regulation.

Here, then, in these up-to-date compressors you have every essential of power economy. In "NE" and "NF" compressors every horse-power of energy applied returns a higher value in compressed air than in any other types within their range of sizes.

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COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: Sherbrooke, Que.

Sydney Montreal Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

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Send in your specifications and get our quotations.

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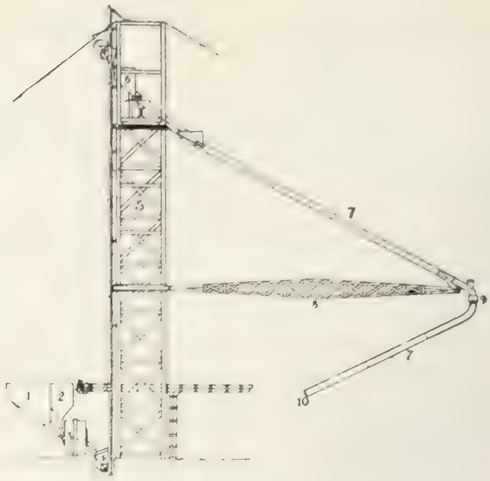

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A system that improves the concrete and reduces the cost.

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Competition is met and profitable contracting achieved by the use of up-to-date equipment in every branch of the contracting business.

When it comes to digging let your men do more efficient work by supplying them with "Lundy" or "Dandy" shovels.

They enjoy a national reputation for rigid construction and durability.

We will send to any contractor, free, express prepaid a sample shovel. Send for our illustrated catalogue showing our full line of Shovels, Spades, Scoops, Draining Tools, etc.

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Estimates furnished promptly. Capacity 18,000 Tons Annually.

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Engines and Boilers

of all types and sizes, Heaters, Tanks, Pumps, etc.

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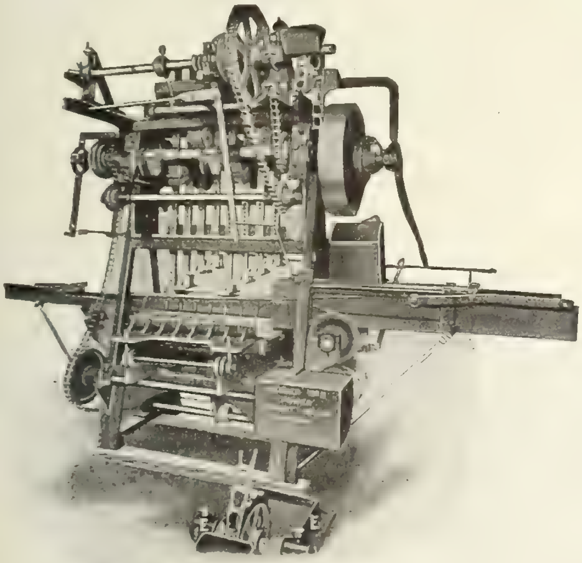
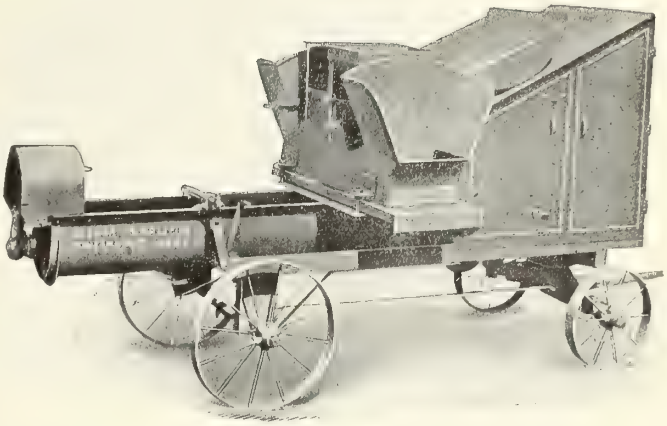
Cement Bricks

Here are the two Besser machines that make the best cement brick on the market. The Brick machine that will make 30,000 bricks per day—every brick the same.



Besser Power Cement Brick Machine



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Oakley Myers, Amherst, N.S.

Hardens with Age. Low Price. Samples and Quotations Free

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SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
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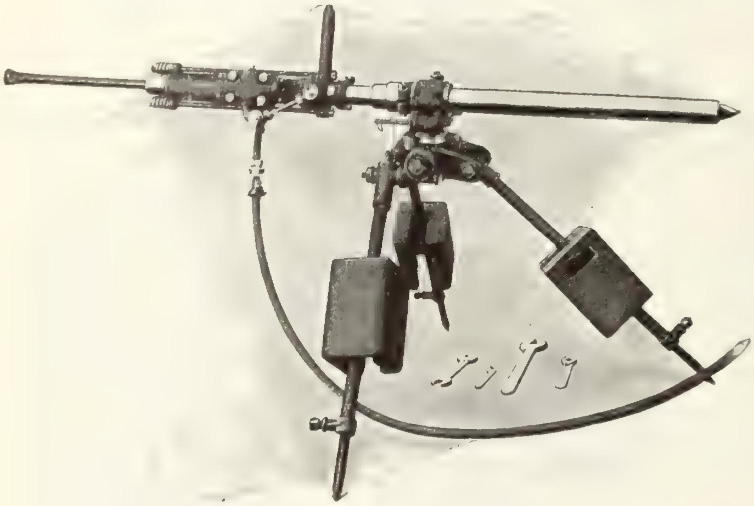
DRILLS and COMPRESSORS

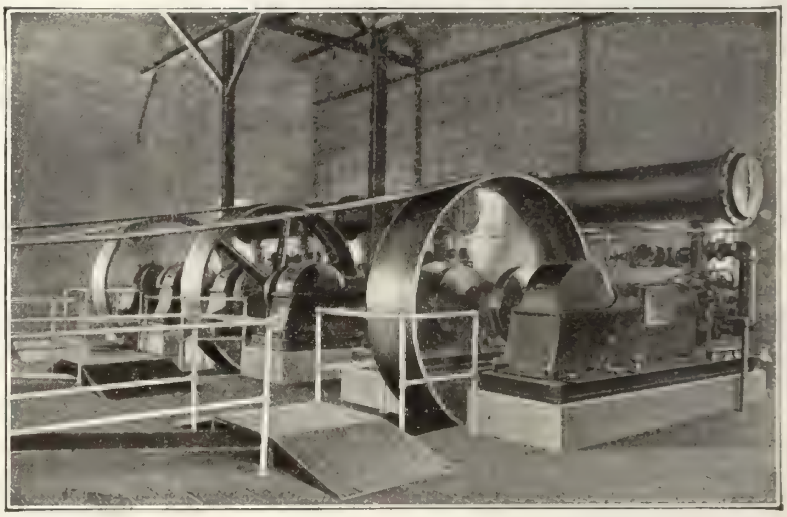


A-5 Drifter Mounted on a Standard "A" Tripod

After prolonged tests in mines, quarries and on contracting operations, the **McKiernan-Terry Drill Company,** has developed a tool, which for sinking, stoping or drifting, may in most cases be more profitably employed than any other type of drill. As a combination drill, used for any one, or all, of the three kinds of work mentioned, it is a fast driller to a depth of 12 feet and though much deeper holes may be drilled, its rapidity of cutting is diminished.

In the design of the **Blaisdell** Air Compressors all principal bearing surfaces are provided with a flood lubrication, thus insuring freedom from trouble and resulting in absolute reliability of service.

These points will especially appeal to those running power plants in which continuous service is an absolute essential and to those to whom in most cases, a breakdown would involve serious delay and loss.



CANADIAN ALLIS-CHALMERS, LIMITED

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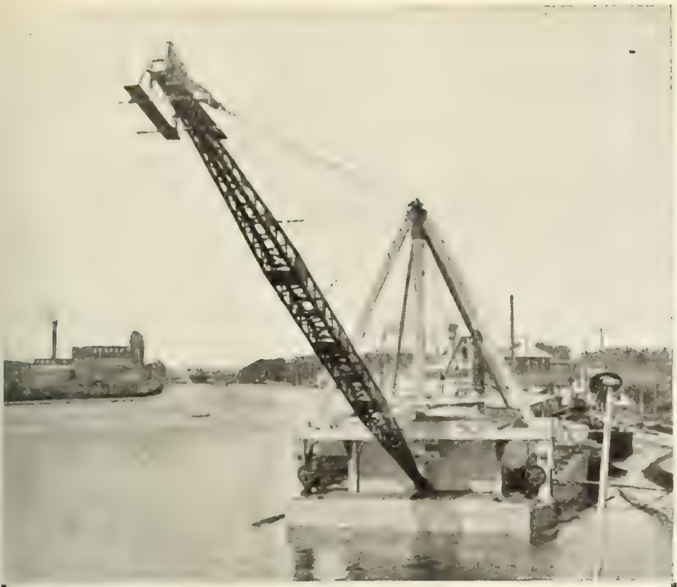

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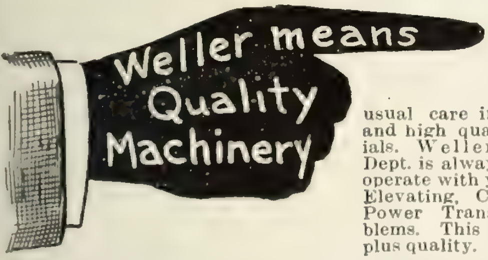

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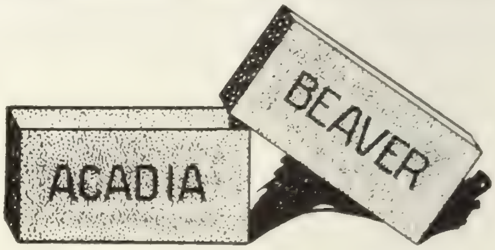

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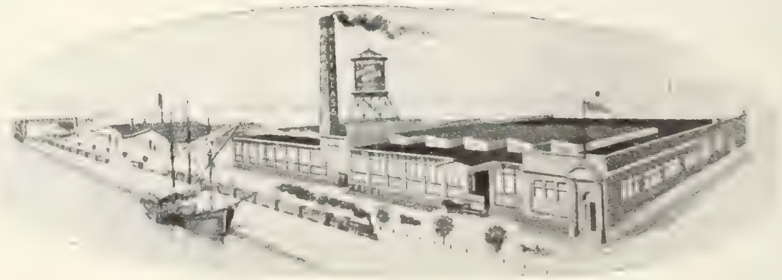

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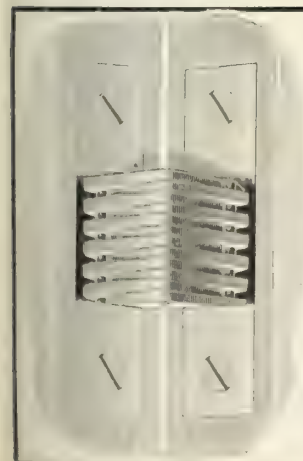

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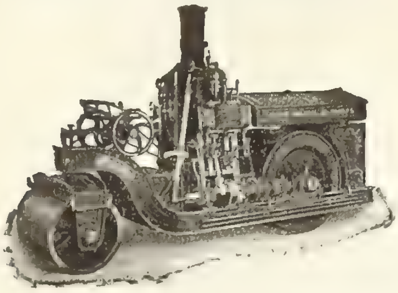

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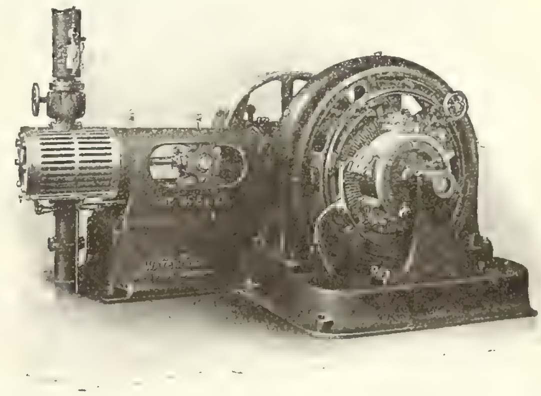

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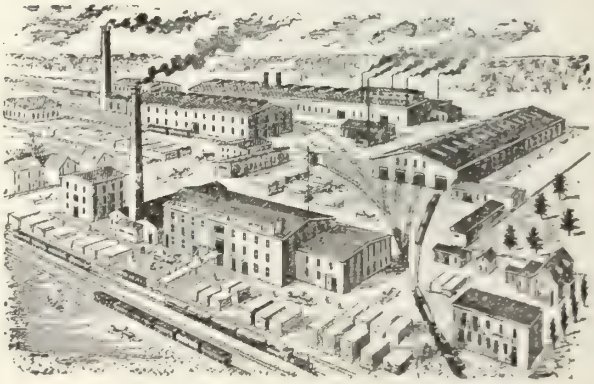

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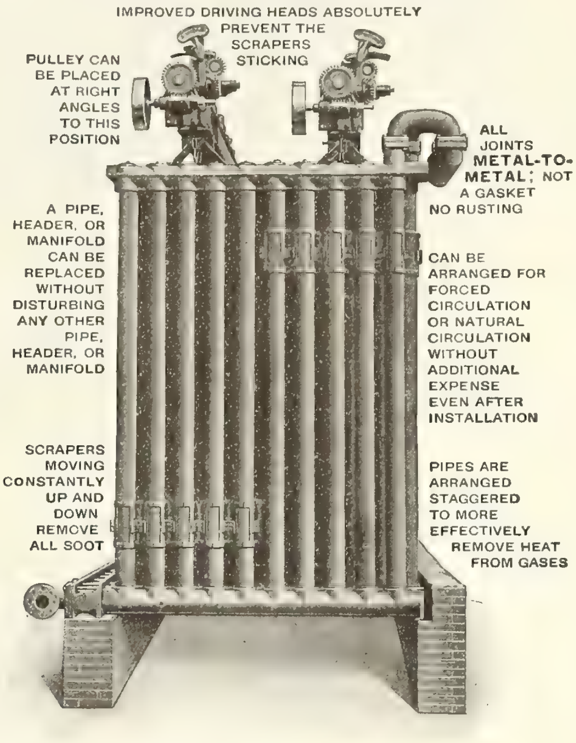
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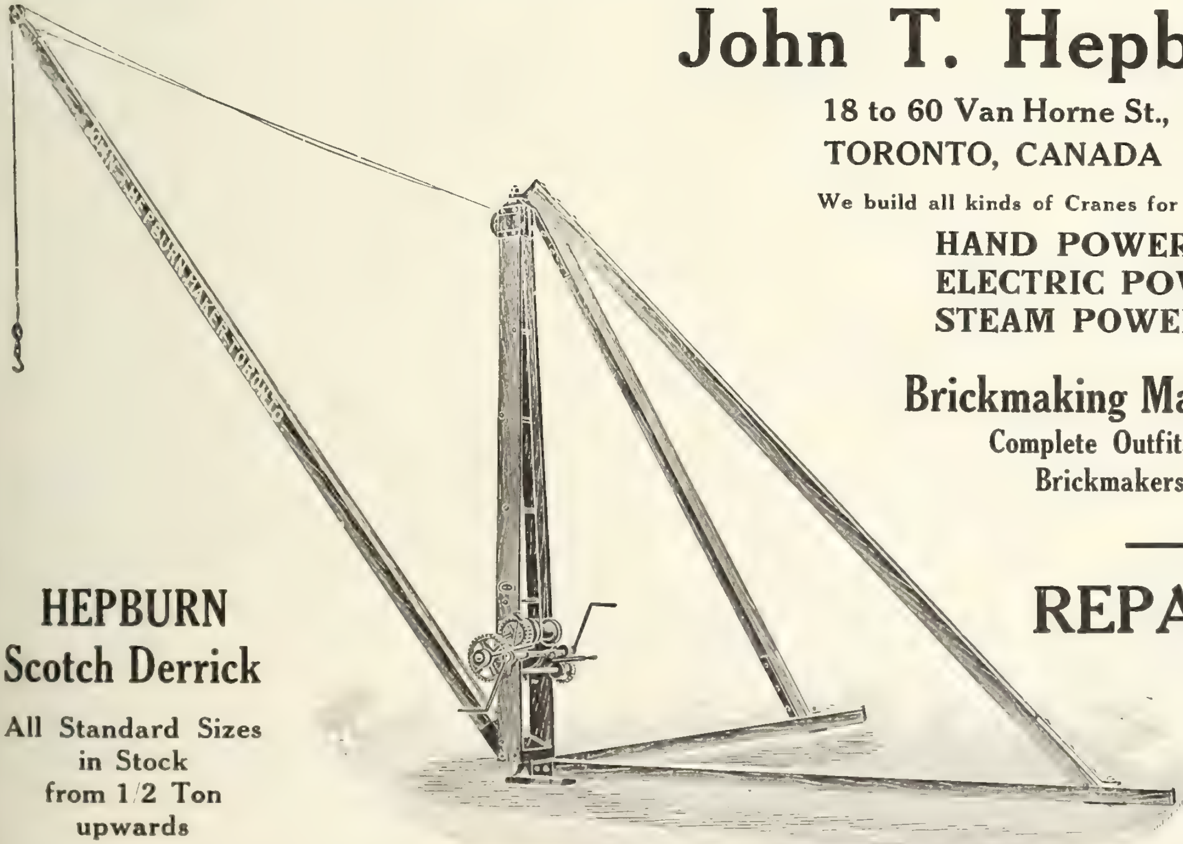
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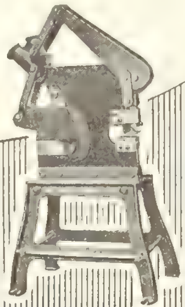

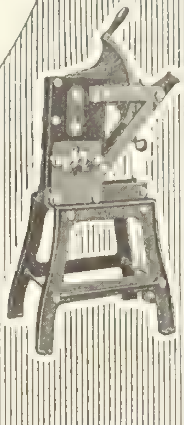

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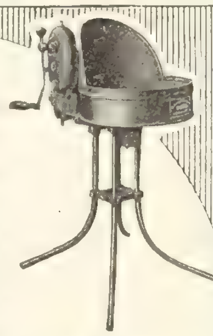

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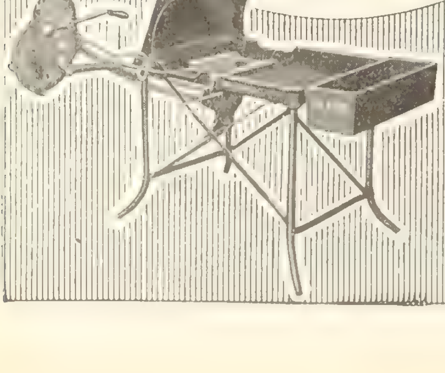

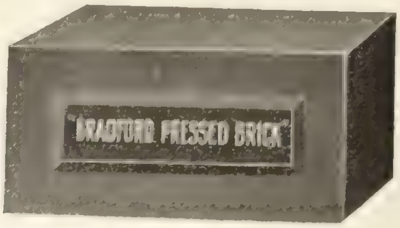

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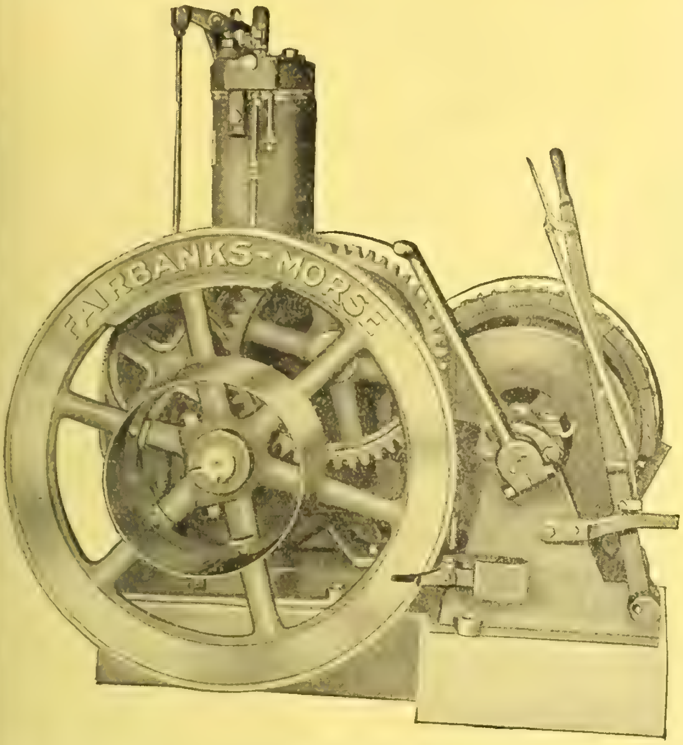
Bradford, Pa.

Vertical Geared Hoisting Engine



The Fairbanks-Morse Type "T" Vertical Geared Hoisting Engine shown here is one of the most economical, durable and efficient hoists on the market. This is a 6 h.p., but they are made in sizes from 2 to 12 h.p. They are regularly fitted for gasoline, benzine or naphtha, but can be furnished to operate on oil or alcohol.

The drum runs loose on the shaft, while the large gear is keyed fast. A friction clutch mechanism, with conical surfaces, is mounted on the drum, which enables the load to be handled quickly and positively by means of a hand lever. The gearing connecting engine to the hoist drum can be thrown out of mesh, when it is desired to use the engine for other purposes.

Always Satisfactory for

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Across Canada with the

Imperial Wire & Cable Company, Limited

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This picture shows the

Parliament Buildings, Edmonton

This building was wired with
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Architect: A. M. Jeffers, Edmonton.
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"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"

Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

Brickyards, Quarries, Mines, Contractors, etc.

All sizes for any practical gauge

We will be pleased to submit full particulars.

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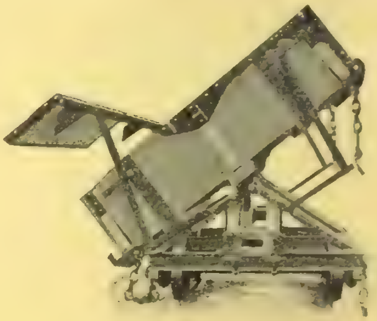

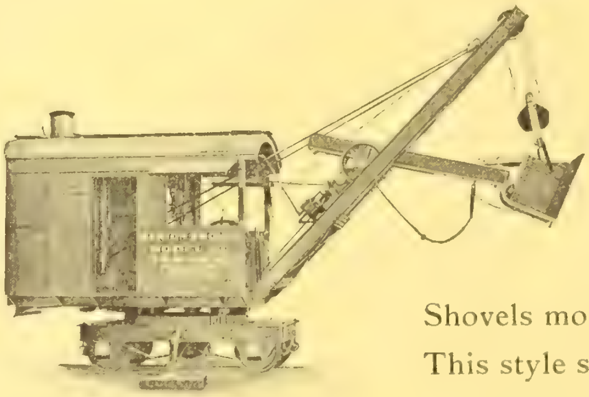

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Revolving Type

This type shovel is supplied in three sizes

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Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

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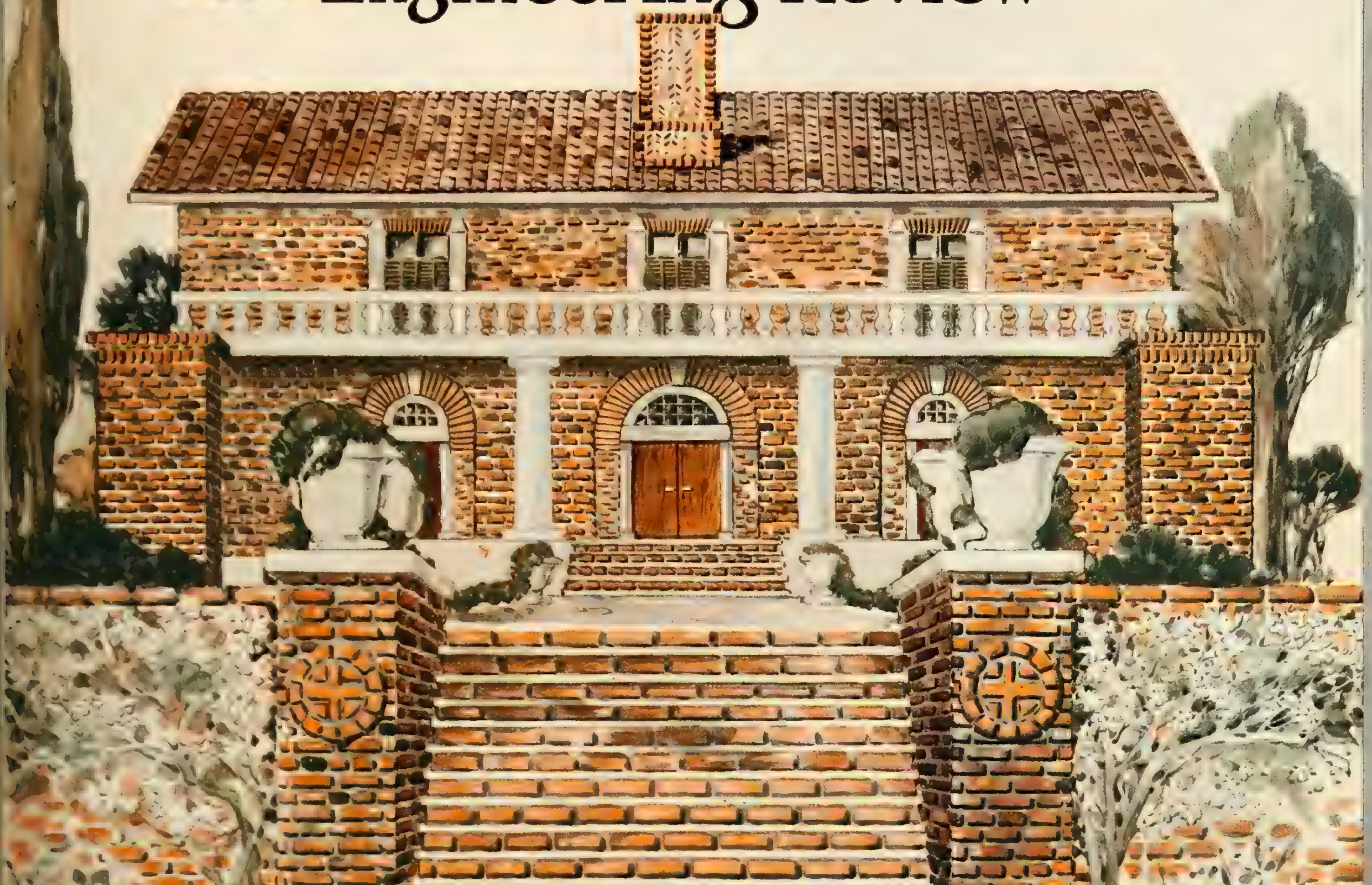

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You want brick
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Let's get together

Sun Bricks are exceptionally hard and uniform in color and quality.

They are burned in a continuous producer gas kiln which gives a continuous uniform burn.

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SOME men ask for so many bags of "cement"—

Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
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TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

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Fitted with Cast Steel Wheels
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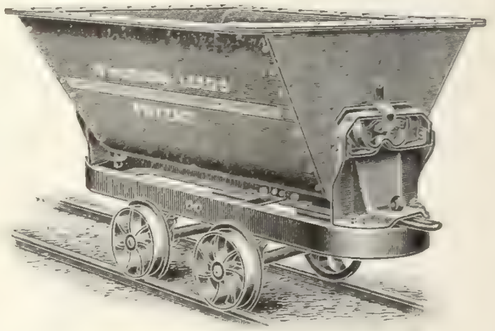

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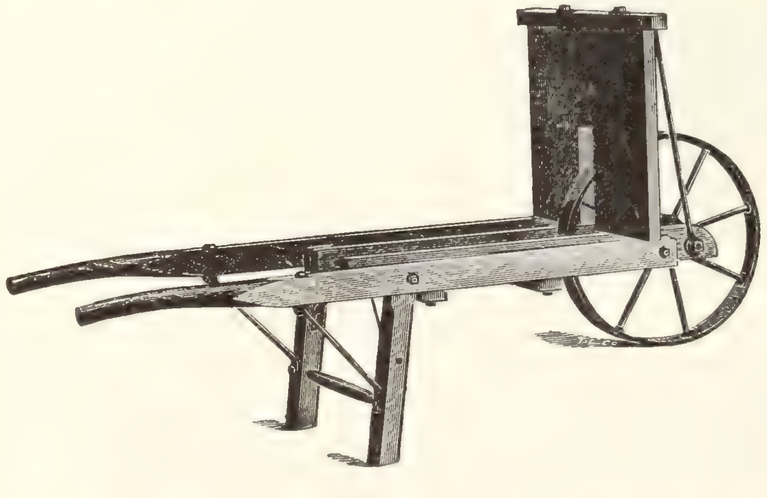

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for all purposes

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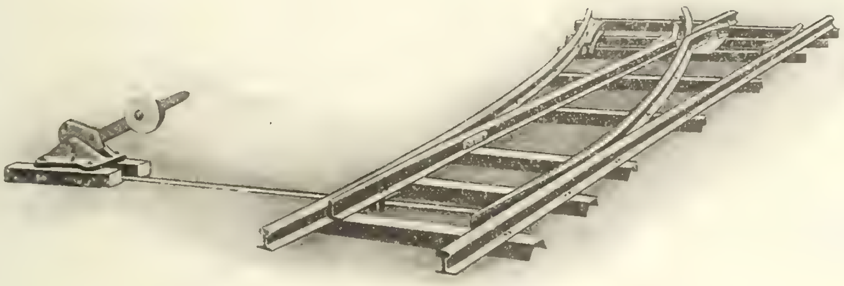

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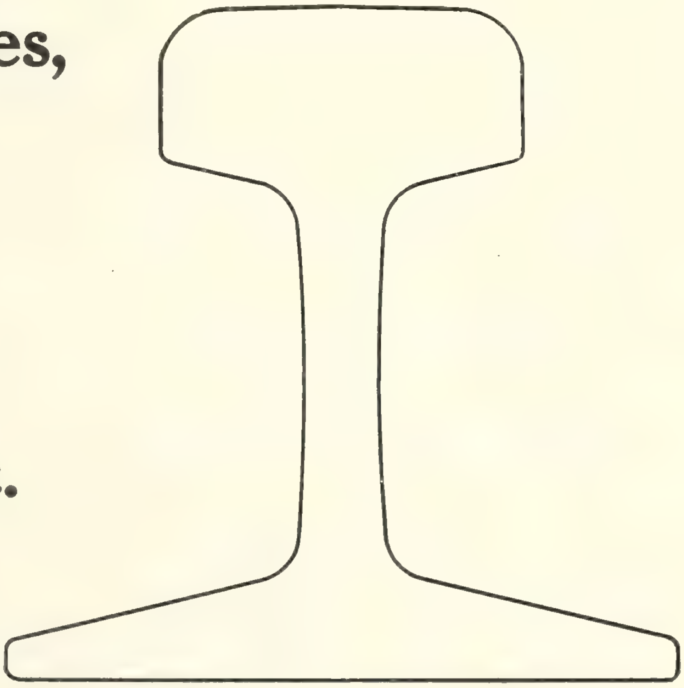

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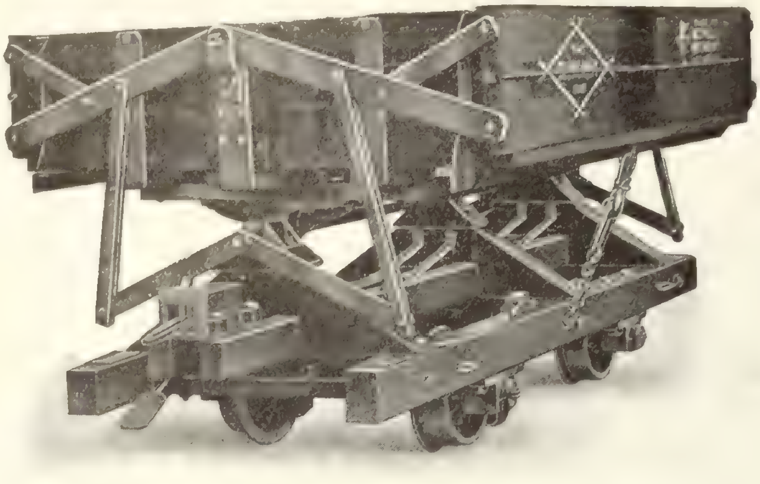

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Equipment is Used on all
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Small Size Dump Cars

For contractors on small jobs, or for jobs where larger capacity cars are not required.

Showing standard construction of our Wood Frame Dump Cars 1¼ and 1½ yds.

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Manufactured Exclusively by

The Schell Foundry & Machine Company, Limited

Write for prices. Alexandria - - Ontario *Send for photographs.*

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By Using a

THEW SHOVEL

for that EXCAVATING CONTRACT

The contractor with men and teams cannot compete successfully with the man who owns a THEW SHOVEL.

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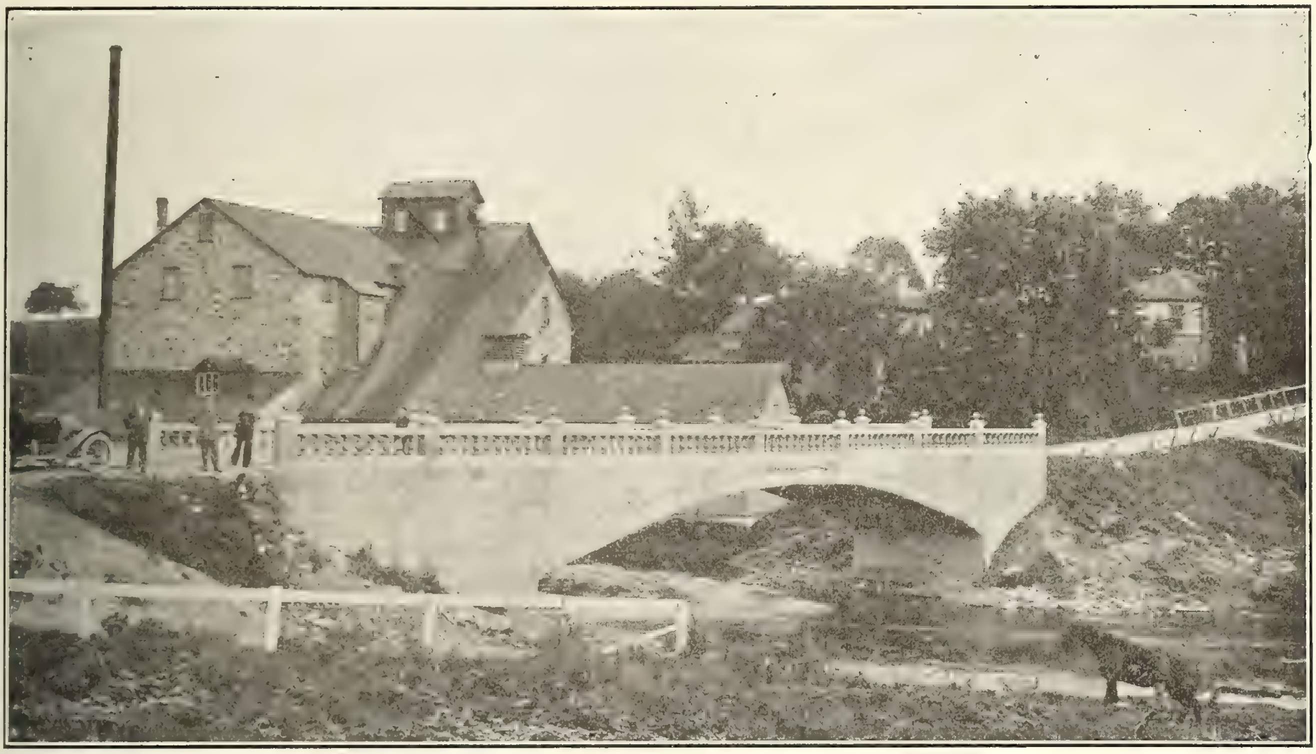
AND CRUSHED STONE



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Our crushed stone is free from dust, dirt and mold—it is really clean stone —properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

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Shovels
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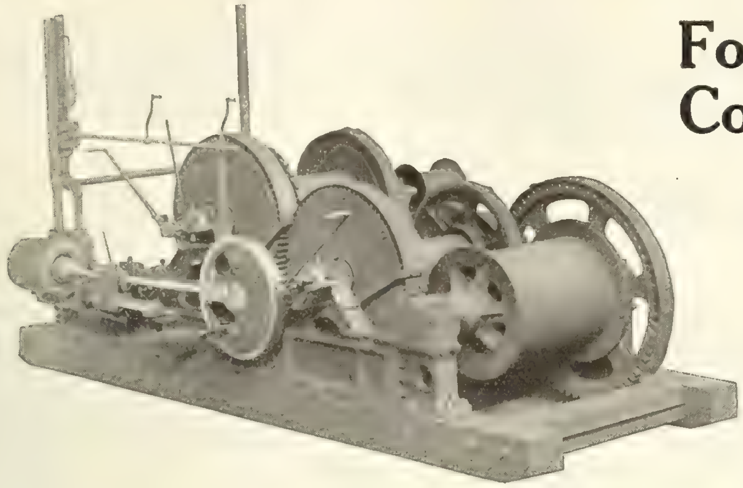
(Continued on page 14)



For Speedy, Powerful, Consistent Excavation

That's what the

"AMERICAN" Excavator Engine

was designed for

The front drum has a pulling power of 20,000 pounds on generous diameter—24 inches, insuring rope economy. The rear, or 16-inch drum, has a single line lifting capacity of 10,000 pounds. The powerful front drum pulls the drag line bucket with an even, plowing effect through the material to be excavated. When full the bucket is lifted by means of the line from the rear drum and is kept from dumping until desired, by maintaining a slight pull on the front drum line. When it is desired to dump the bucket this is released and the load is discharged automatically.

Everything about the engine bears evidence of tremendous power and strong construction. The front drum has a shaft 5⅜ inches in diameter; the rear drum and the friction quill have 4⅛-inch shafts. The front drum brackets are especially reinforced against shocks incident to drag-line service by four heavy tension bolts which tie the shaft bearings to the frame. Weldless cut forged steel gears.

Made by

AMERICAN HOIST & DERRICK CO., - St. Paul, Minn, U.S.A.

SOLD BY :—General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot, Ltd., Vancouver, B. C.
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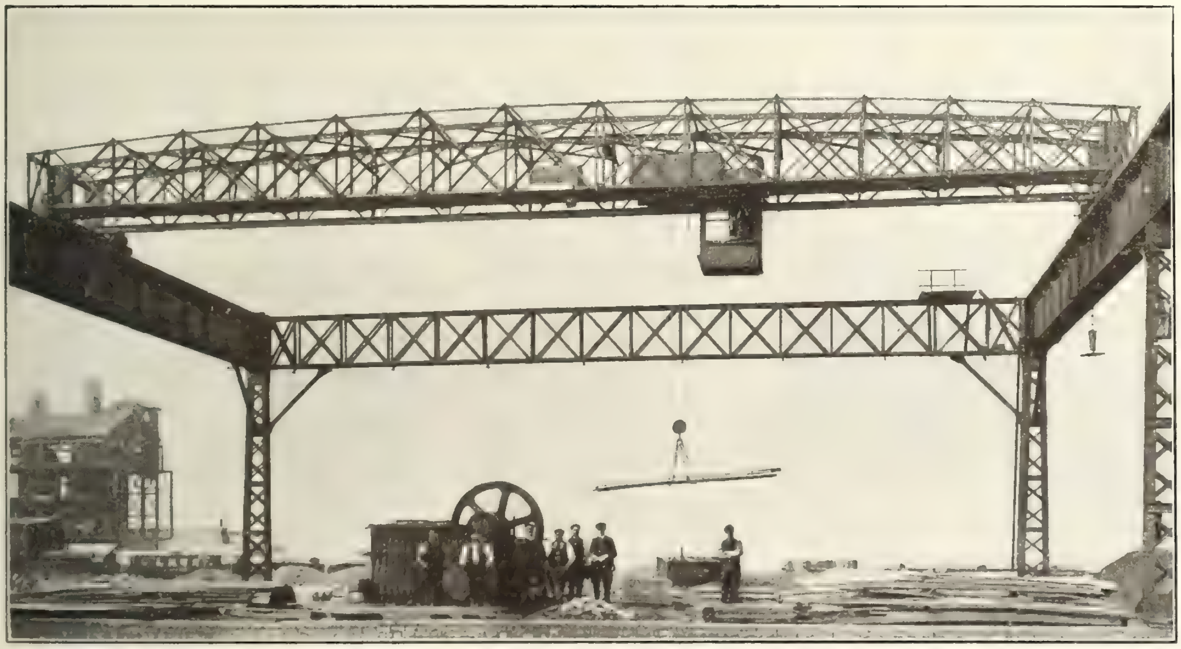

Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

Royce

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Cranes
Capstans
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Include Royce Crane Type Motors, Controllers, Over Hoisting Safeguard.

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CRANES TELFERS CAPSTANS WINCHES

ROYCE, LTD., Trafford Park, Manchester, England

"Superior Graphite Paint"

For the Protection of Steel

Is used so largely because it has behind it a successful reputation of 25 years. Its use insures either exposed or enclosed surfaces, against rust.

Leading ENGINEERS and ARCHITECTS specify "Superior Graphite Paint" for all metal work because for similar work it has shown ACTUAL PROVEN MERIT.

Write for new booklet on PROTECTING STEEL STRUCTURES, and for full information to

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Made in U.S.A. by Detroit Graphite Co., Detroit, Mich.

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The Locomotive illustrated was built for MacKenzie, Mann & Co., Contractors, Montreal, Canada, and represents the latest development in this type of locomotive.

It is suitable for contractors, quarries, mines and industrial service. It will haul 1,875 tons on level, and 160 tons on 3 per cent. grades.

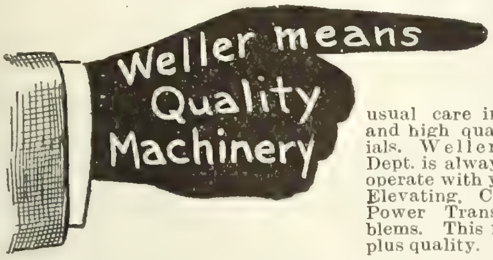
Consult us when in the market for new locomotives. Let us help you select the locomotive best suited to your needs.

MONTREAL LOCOMOTIVE WORKS, LTD.

DOMINION EXPRESS BUILDING, MONTREAL, CANADA

WELLER-MADE

is a guarantee to
Service and Quality



Weller-Made does not merely represent so much "machinery" — it stands for unusual care in construction and high quality of materials. Weller Engineering Dept. is always ready to cooperate with you on all your Elevating, Conveying and Power Transmission problems. This means service, plus quality.

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Such as SPIRAL CONVEYORS—BELT CONVEYORS—CAR PULLERS—SCREENS—DUMP CARS—POWER SHOVELS—ETC., ETC.

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You should have a copy of this valuable catalogue before you. Sent free upon request.

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Co., Chicago
New York Office;
50 Church St.

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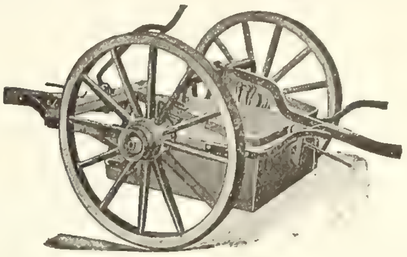

S by themselves Co.

Western Wheeled Scrapers

are acknowledged by contractors and others to be the only practicable and durable wheeled scrapers made.

No other scraper has the heavy construction, spring back hooks, and reversible sleeve spindles and sand caps of the Western.

We have a catalogue waiting for you—send us your name and address.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery

Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta.
Can. Equipment Co., Montreal—Agents for Eastern Canada.

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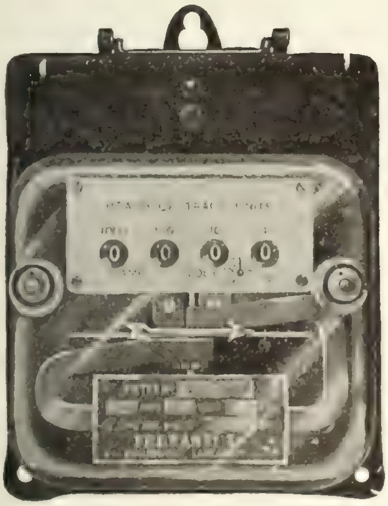

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Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
Top or bottom connections.
Prompt deliveries.
Every meter carefully inspected before shipment.
Absolutely guaranteed.

Send us your probable meter requirements and let us make you a proposition.

Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

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Wrenches
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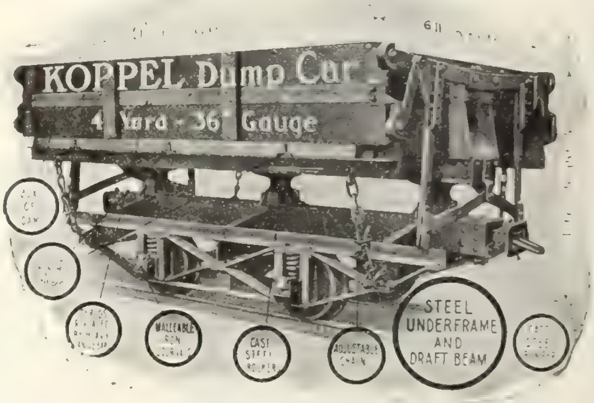
What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

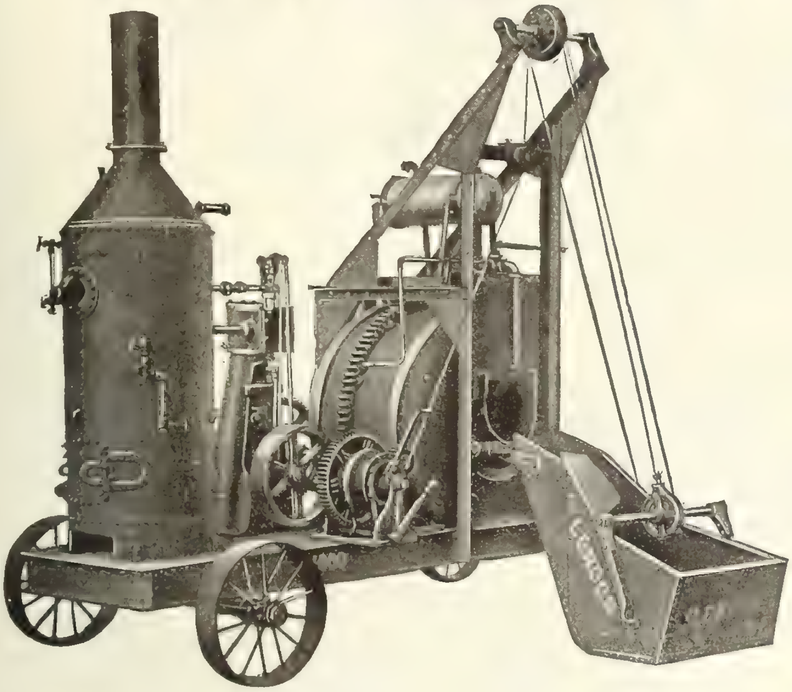
Orenstein - Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

CONCRETE MIXERS



London Standard Drum Batch Mixer

Several Kinds, and built in sizes to suit all classes of work

The many improved features of the London Mixers have placed them in a class by themselves.

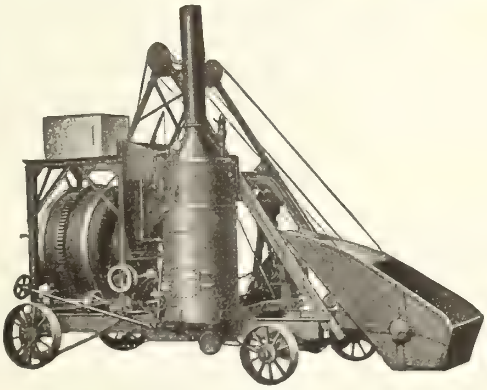
We can save the contractors money—

On First Cost
On Cost of Maintenance
On Cost of Operation

SEND FOR OUR CATALOGUE

We manufacture a full line of Concrete Machinery and Cement Working Tools.

Also a full line of Hoisting Engines and Contractors' Equipment.

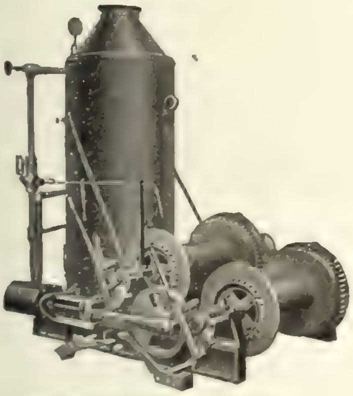


Rear Discharge Paving Machine with Forward Loader

Every machine made in our own factory.

Our machines are not made down to a price, but **made up to a standard.**

By manufacturing on a **large scale** we have been able to offer **high grade machines** at **remarkably low prices.**



Standard Hoisting Engine

We are the Largest Manufacturers of Concrete Machinery in Canada

No. 2 Automatic Batch Mixer

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:
WINNIPEG (445 Main St.) W. H. Rosevear, Mgr.
CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (60 Richmond St. E.) F. D. Emsley, Mgr.

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REGINA, H. A. Knight
FORT WILLIAM, Northern Eng. & Supply Co.
MONTREAL, Foss & Hill Mach. Co.
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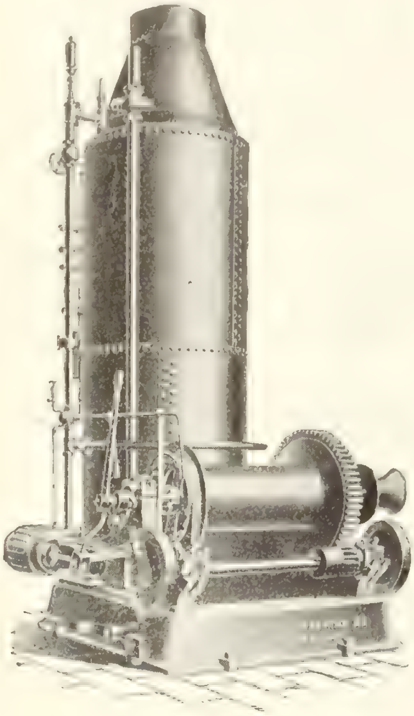

Hoisting Engines

¶ To the Contractor who wants a good reliable and efficient hoisting engine, — one that will always be right on the job—we suggest an inquiry into our wide range of this type of machine.

Any one of our offices will help you find the engine best suited to your needs.

The JENCKES MACHINE COMPANY, Limited
General Offices: SHERBROOKE, QUE.
WORKS SHERBROOKE, QUE. ST. CATHARINES, ONT.
Sales Offices:
Sherbrooke, St. Catharines, Nelson, B.C., Vancouver, Montreal, Cobalt, S. Porcupine

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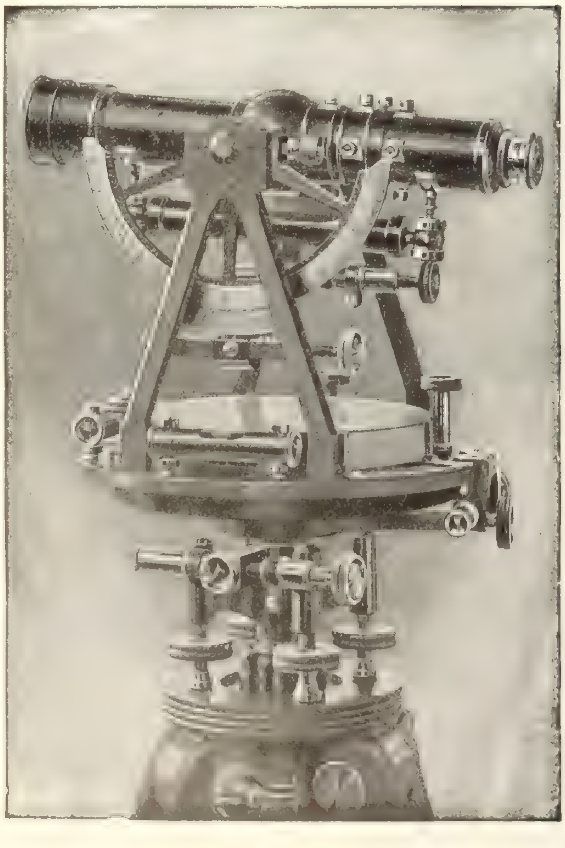

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Largest Manufacturers in America of

Field Instruments

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Transits	Current Meters
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Also Makers of

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Branch Factory: 315 Maritime Building, Seattle, Wash.

Latest edition of Gurley's Manual sent on Application.

Tarvia

Preserves Roads
Prevents Dust~

Brant Road, Galt, Ont., Canada. Constructed with Tarvia Modern Pavement.

Of Interest To Taxpayers

A cloud of dust behind an automobile means that the road surface is being destroyed—blown away. It also means that the road is unfit for modern traffic—that it has been built in the old way intended for slow-moving, horse-drawn traffic.

The science of MacAdam has been rewritten these last few years. A mineral binder is no longer enough to hold the stone together.

Something stronger is needed, and the use of Tarvia is the logical and necessary answer to a difficult problem.

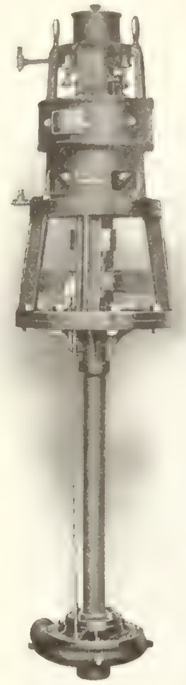
In the tarviated road, there is a matrix of Tarvia around each stone, holding it firmly to its work and preventing it from shifting. There is no internal movement and the attrition of traffic is reduced to a minimum.

If the road is built with Tarvia the extra cost of the treatment is more than made up in longer life and reduced maintenance costs.

Tarxia is made in three grades—"Tarvia X" is a dense, viscid coal tar product of great bonding power, suitable for building macadam roads; "Tarvia A" and "Tarvia B" are thinner grades suitable for roads already in use, to preserve them and make them dustless.

Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.



A Special

PUMP

For Your
Special Needs

The above is obtained by
placing the matter
with

The
**Smart-Turner
Machine Co.,**
Limited,
HAMILTON, ONT.

"MADE IN CANADA"

**Bent
Glass**

Made in all
Kinds of
Glass
on Short
Notice

Large Bent Plate Glass for Shop
Fronts a Specialty

**The Toronto Plate Glass Importing
Company, Limited**
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
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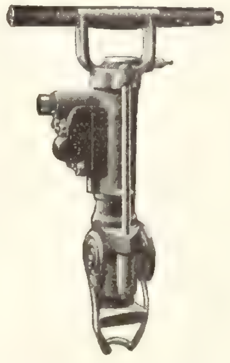

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**Canadian
Ingersoll-Rand
Co., Limited**
MONTREAL, CAN.

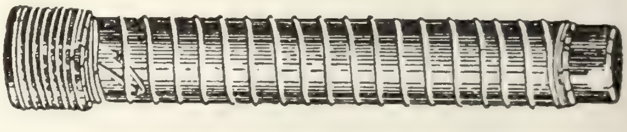
**THE
"JACKHAMER"**

A Small, All-Steel,
Easily Handled Tool
for use in

**DIGGING DITCHES
DRIVING TUNNELS and
BREAKING UP STONE**

This tool is light in weight and handles steels up to 6 feet in length.

It has an Automatic Rotation and can be operated by Steam or Air.



Continuous and Machine Banded Wood Stave

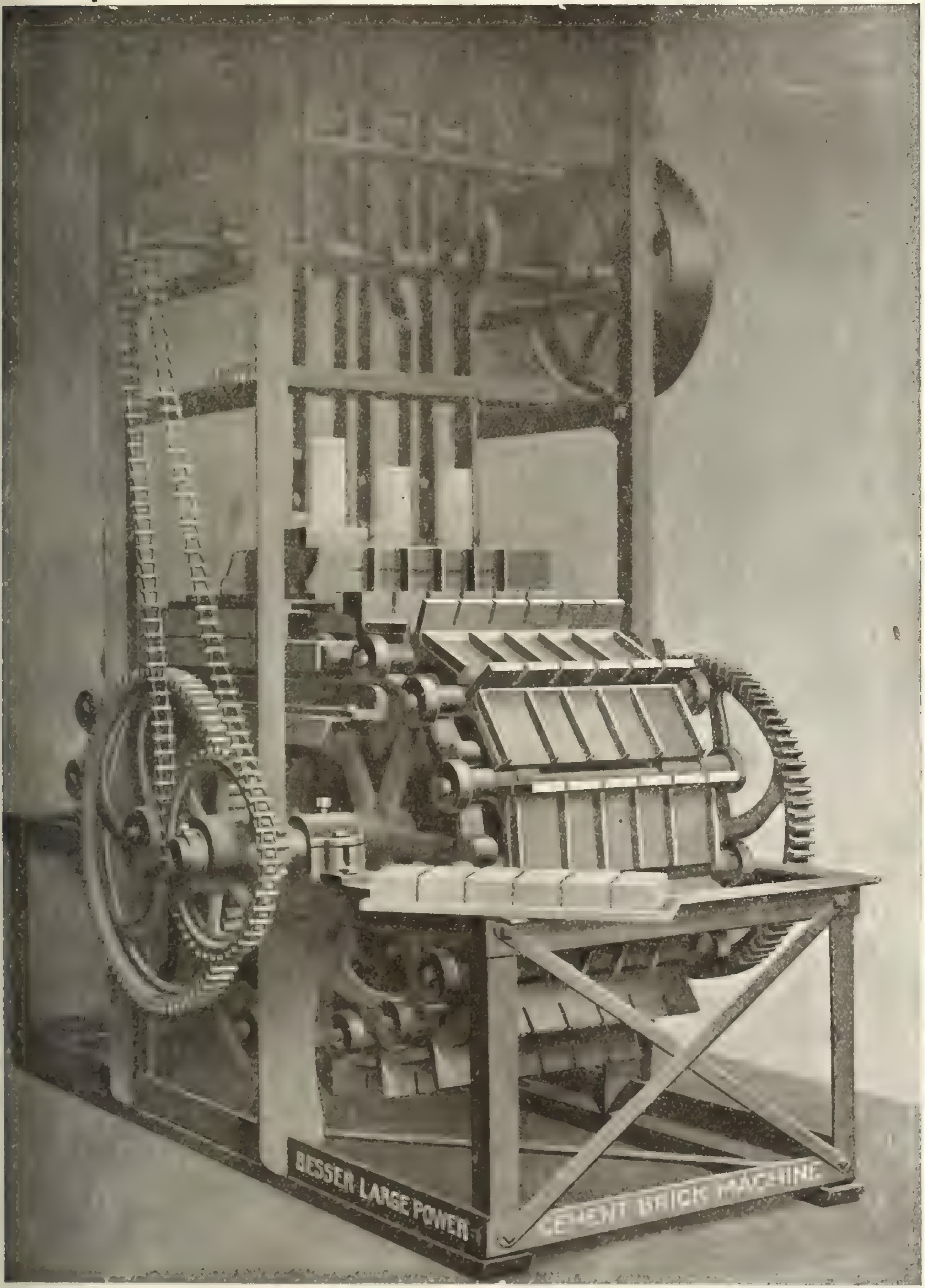
WATER PIPE

RESERVOIR TANKS

for city and town Water Systems,
Fire Protection, Power Plants,
Hydraulic Mining, Irrigation, etc.
One-half the cost of Iron Pipe—
and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Cement Brick



The Besser Power Brick Machine has a capacity of from 50,000 to 60,000 bricks per day. These brick are being made on this machine for from $3.50 to $4.50 per thousand. They compete in price and exceed in quality the clay brick made by the old-fashioned, expensive kiln-burning methods.

This machine **tamps** the cement mixture into brick molds. The mixed material is elevated into a hopper, which feeds into sets of molds revolving on a cylinder. These molds pass under automatic power tampers which **tamp** the molds full. The **surplus** mixture is scraped off automatically, the face of the brick is troweled and two mechanical arms pick up the palletfull and deposit it on the kiln car.

No human hand touches the material from the mixer to the curing rooms—the machinery does it all.

The result is a dense cement brick, hard as flint. It is stronger, more waterproof than a clay brick and can sell for the same, or a lower price.

We make a machine of smaller size with a capacity of 25,000 brick per day. Ask for our Power Brick Machine Catalog.

BRICK ON THE FLAT

This machine makes a first class common building brick. They are made on the flat, which has many advantages. It allows the use of **wet material**, which means everything in the manufacture of a good brick. The use of enough water gives a hard flinty product and is much different from the excessively dry concrete, generally used.

Making them on the flat allows us to trowel the face and leave the flat side more rough. In this way the brick hold the mortar better and the face has a nice appearance, as the trowelling is applied where it belongs.

THE PROFITS

We are prepared to show that the manufacture of cement brick with this simple, large capacity machine is one of the most profitable enterprises that you can take up. It is a large factory proposition and the lessened cost of production removes you from competition with cheap methods.

Estimates of profits, etc., furnished upon application. To our customers we furnish plans and specifications, and always supply our expert to start the machinery.

Woodstock Wind-Motor

Company, Limited

WOODSTOCK, ONTARIO

CANADA STEEL CO
LIMITED
HAMILTON CANADA

STEEL BARS

For Reinforcing Concrete

ROUNDS, SQUARES, FLATS, ANGLES,
SPECIAL SHAPES, TWISTED SQUARES.

Bars Bent to Shape for Stirrups, Beams, etc.

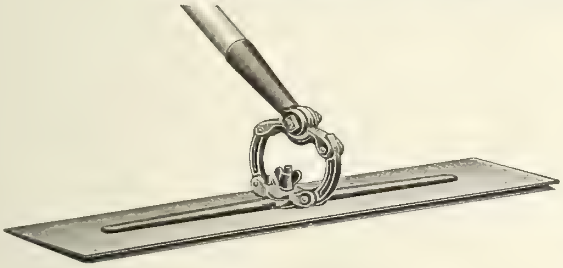
CROSS ARM BRACES

PLAIN AND GALVANIZED

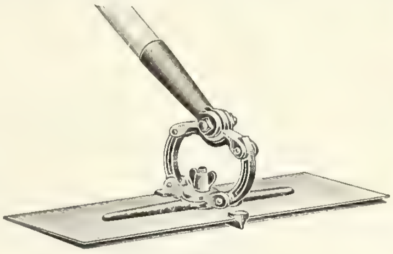
Drift Spikes, Relaying Rails

LOWEST PRICES ON APPLICATION
PROMPT SHIPMENTS FROM STOCK

CANADA STEEL CO
LIMITED
HAMILTON CANADA



Abram Trowel



Abram Jointer

Abram Edger

Special Offer

for December, January and February Only

Our Winter Discounts as announced in this issue of the Record one year ago, proved very attractive to hundreds of wide awake contractors from all parts of Canada, and the orders received were very satisfactory, so we have decided to make the same remarkably liberal discounts for this season, as follows:—

We will allow 20% discount on any tool or on any combination SET of tools as listed in our new catalogue No. 2, on all orders we receive (cash with order) during the month of December 1913.

15% discount on all orders (cash with order) received during the month of January 1914.

10% discount on all orders (cash with order) received during the month of February 1914.

All shipments to be made on receipt of the order, under the following guarantee:—Each purchaser may hold tools until they are given TEN full days trial at actual work, and if they are not satisfactory in every way, they may be returned at our expense and the full purchase price refunded.

Our regular Spring shipping begins March 1st and positively no discounts can be allowed nor free trials given after that date.

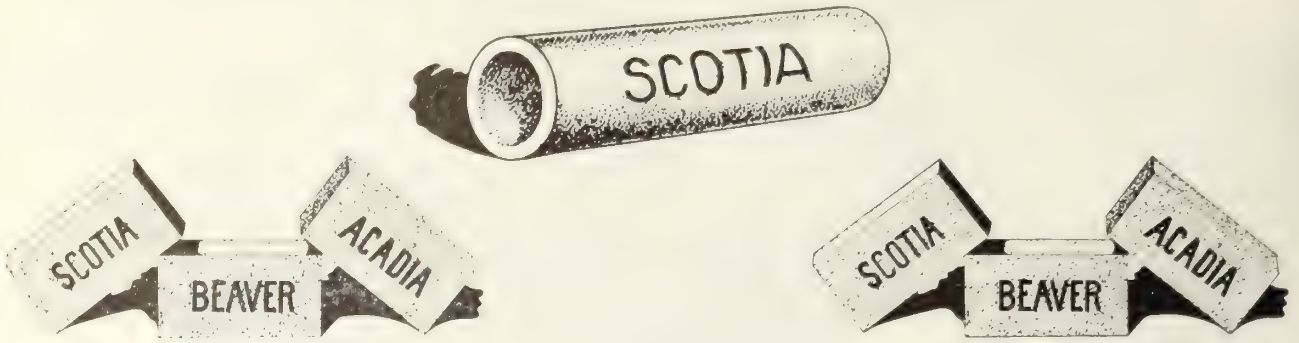
Of the Hundreds of orders we filled under this discount offer one year ago, not a single Set, nor a single tool was returned to us, and we have never yet heard from a dissatisfied customer.

Send today for our large new catalogue No. 2 and take advantage of this remarkable discount offer which appears but **ONCE** a **year.**

Catalog Free

Abram Cement Tool Co.

105 Ouellette Avenue **WINDSOR, ONTARIO**



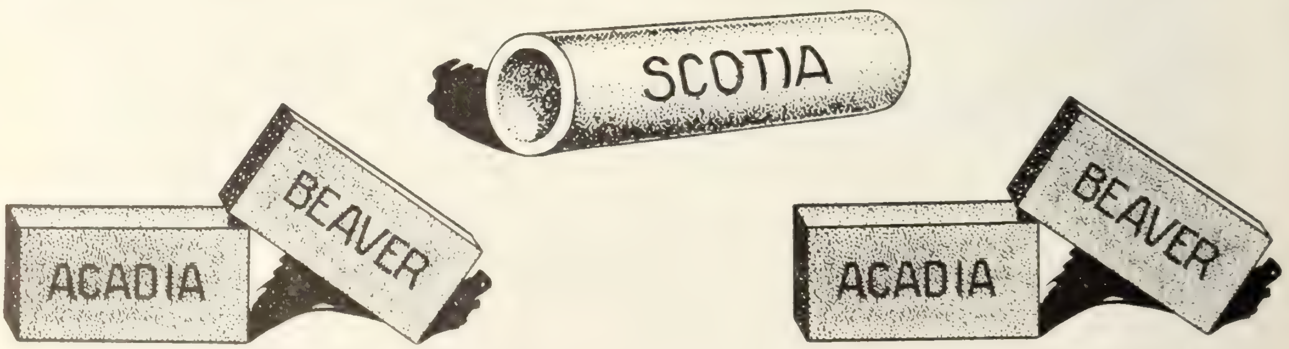
Nova Scotia Clay Products

AT our three plants in Nova Scotia we manufacture an extensive line of pressed and common brick, drain tile and porous terra cotta fireproofing.

Clay particularly well suited to our purpose, and up-to-date machinery enable us to manufacture a strictly high class product.

We will be glad to send you prices and particulars for any of our lines.

Nova Scotia Clay Works
Limited
Halifax Nova Scotia



Builders' Supplies

For Prompt Delivery

Building Stone
Burnt River Rubble

Crushed Stone
Cement

Fire Brick
Fire Clay

Hydrated Lime
Hard Wall Plaster

Pit Run Gravel
Pit Sand

Screened Gravel
Sewer Pipe

Plaster Paris, Weeping Tile
Lime, Hair, Etc., Etc.

OUR PRICES ARE AS LOW AS THE LOWEST. OUR SERVICE IS AS GOOD AS THE BEST. ALL SUPPLIES ARE FIRST GRADE.

Britnell & Co., Limited

C. P. R. Crossing, Yonge St. North, Toronto.
Phone North 664-665

Branch Yard, Merton Street
Phone North 670

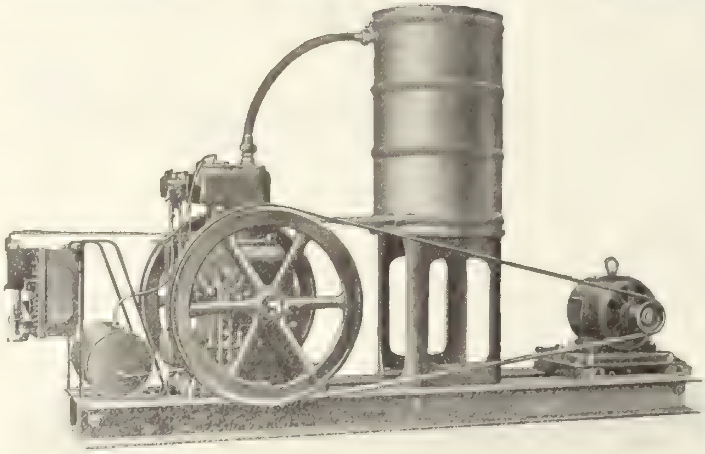
For Contractors and Municipalities

LISTER-BRUSTON

AUTOMATIC ELECTRIC LIGHTING

Suitable for Lighting

Small Towns
Country Houses
Factories
Hotels
Clubs
Churches
Schools
Hospitals
Public Buildings



We have Supplied

Lighting Installation to municipalities and received repeat orders from them.

Requires no skilled electrician to operate.

Cheapest and easiest plant to install on the market.

It is self-starting, self-regulating and self-stopping and generates electricity at the minimum of cost.

Any voltage or capacity.

WRITE FOR CATALOGUE AND FULL PARTICULARS TO

R. A. LISTER & COMPANY, LIMITED

Winnipeg **TORONTO** **St. John, N.B.**

PLANT IN OPERATION AT 190 KING STREET WEST, TORONTO

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

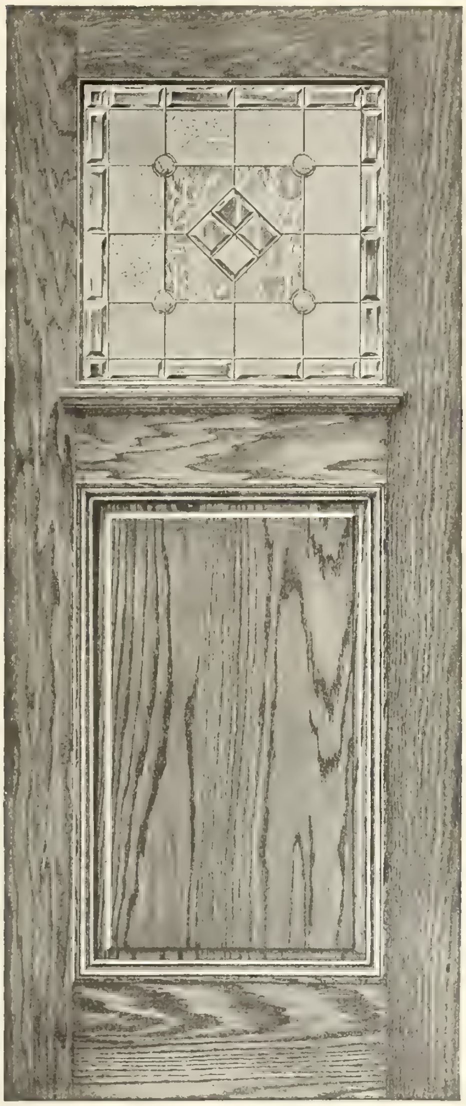
These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

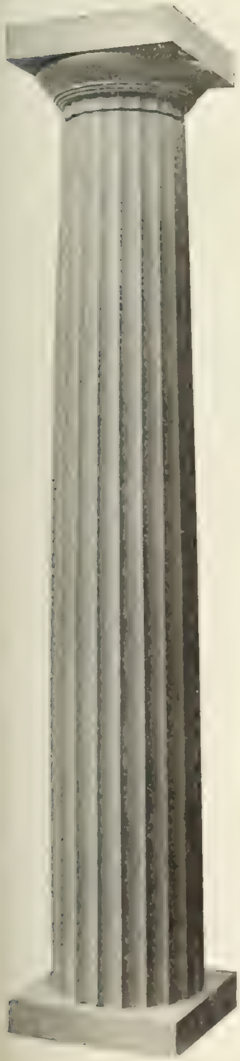
For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

Doors
Base
Balusters
Columns



Sash
Trim
Turnings
Newels

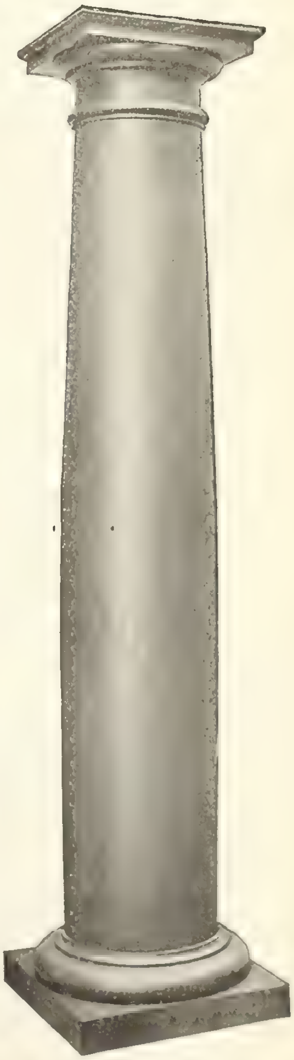


IF you want high-class doors of good appearance and made of selected woods, we suggest Batts Limited as the place to get them. The workmanship in our doors is thorough and all woods are properly seasoned giving the doors long life.

In our columns the special "V" lock joint makes it impossible for them to crack or open.

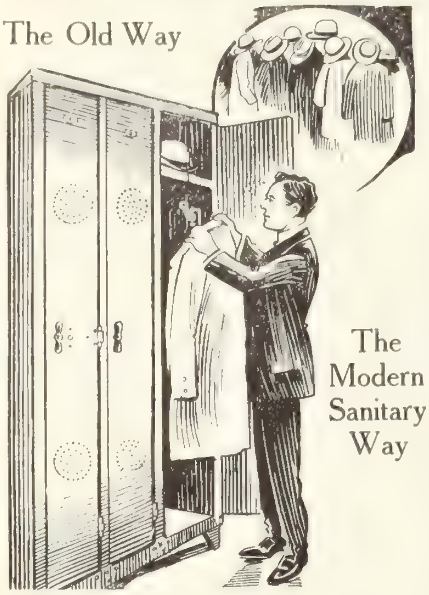
Specify "Batts" doors, columns and trim.

Batts
Limited
Pacific Ave., Toronto



Ornamental Iron and Bronze

Dennisteel Lockers



Dennisteel Lockers

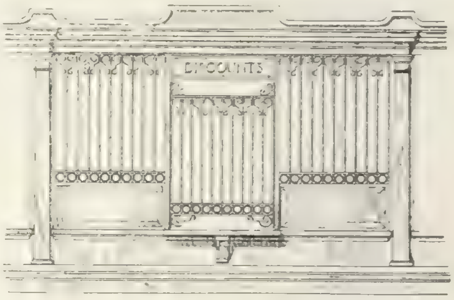
are not an ordinary metal locker, but are particularly high class in construction, while the finish makes the Dennisteel locker especially adaptable for offices, colleges, clubs, schools, banks and institutions where something superior to the ordinary locker is desired.

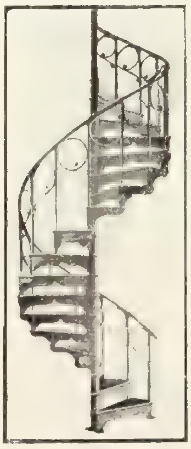
Dennisteel lockers give efficient and lasting service, endorsed by Fire Insurance Underwriters and used where effective organization and system are sought.

Write for special catalogue and prices. "Dennisteel Lockers are the standard for quality in Canada."

Grills and Railings, Iron Stairs, Marquises, Fire Escapes, Dennisteel Lockers and Shelving Balconies, Lamp Standards, Wire Work, Tellers Cages and Wickets.

Architects' Designs
Faithfully Executed
in Iron, Brass
and Bronze





Original and Artistic designs submitted for all classes of work.

Separate catalogues of each line sent on request.

Dennis Wire & Iron Works

Company, Limited, London, Ont.

The B. Greening Wire Co.

Limited

Established 1859 Incorporated 1889

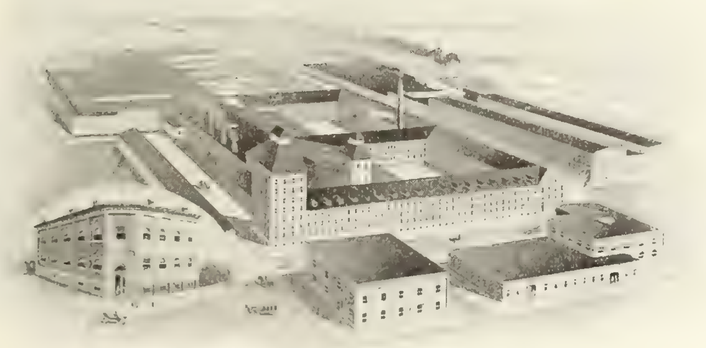
Manufacturers of

Wire Cloth

Brass, Copper,
Bronze, Galvanized
and Steel

Perforated Metals

Brass, Copper,
Bronze, Galvanized
Iron and Steel



Works and Head Office, Hamilton, Ontario

Wire Work

Machinery Guards,
Tool Room Partitions,
Factory Window Guards

Steel Wire Chain

Thirteen Sizes.
Special Sizes made to order

Wire Rope

Rope Fittings Rope Grease

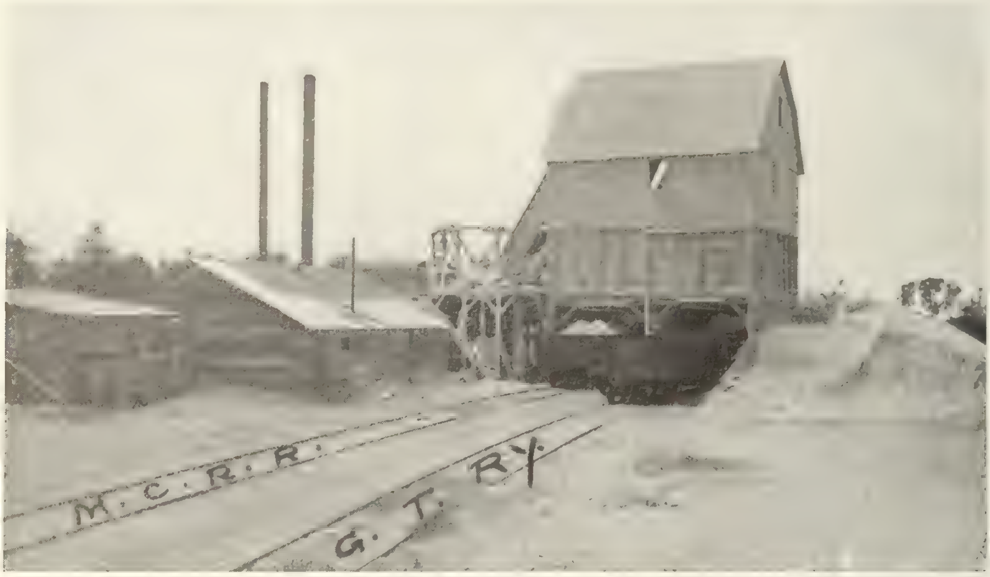
Write for catalogue

HAMILTON, ONT. MONTREAL, QUE.

CRUSHED STONE

For Concrete and Macadam

THE TOUGHEST STONE FOR MACADAM IN ONTARIO



Crushing Plant at Our Quarries

Capacity 1,000 tons per day.

The only quarry producing the famous **Hagersville Blue Stone,** the best for road work in Ontario.

Used exclusively by the Counties of Middlesex, Oxford, Brant, Lincoln, Halton, Peel and York; and the Ontario Government roads.

Hagersville Contracting Co., Limited

Office and Quarries: Hagersville, Ontario

Correspondence Solicited

Stone delivered on G. T. R., M. C. R., C. P. R. and T. H. & B. Railways

J. C. Ingles, Mgr., Hagersville, Ontario

Bell Phone No. 2

Office and Factory Buildings of
THE NATIONAL CASH REGISTER COMPANY, DAYTON, OHIO
2,500,000 Buff and Gray Brick, manufactured by The Columbus Brick and Terra Cotta Company, Columbus, Ohio, were used in the facades of these buildings

Our Astrakhan Brick is the most perfect, rough texture brick on the market in size, shape and quality.

Made in BUFF, ONYX, GRANITE, GRAY and FLEMISH

DRY PRESSED Gray, Buff Speckled, Gray Speckled Standards and Normans

WIRE CUT . . Ivory and Gray in Standards only

ORNAMENTAL In all colors

BRICK MANTELS AND ARCHES MADE TO ORDER

The Columbus Brick & Terra Cotta Co.

ESTABLISHED 1885

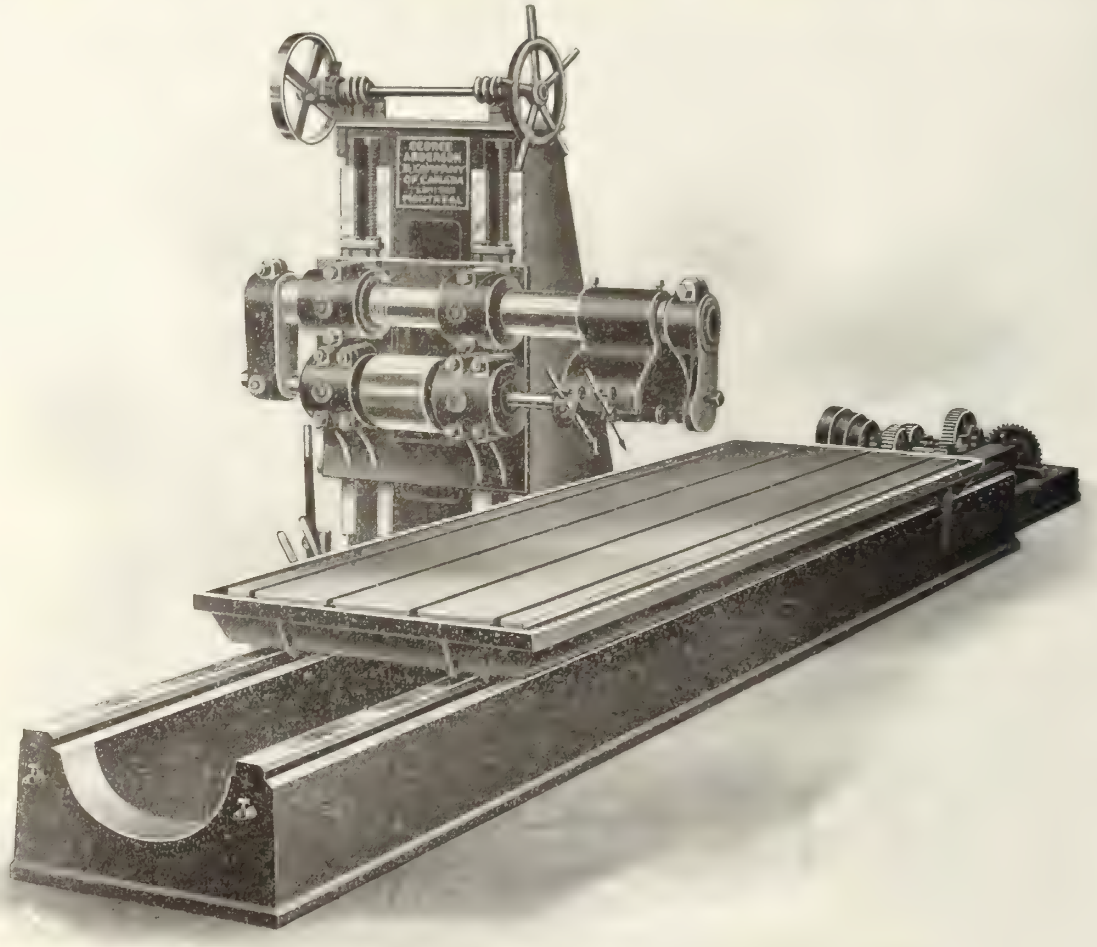
Main Office: COLUMBUS, OHIO

Works: UNION FURNACE, OHIO

Canadian Agencies:

Hamilton Gordon K. Fraser
Toronto—Black Building Supply Co., Ltd.
Calgary—The Waite Fullerton Co., Ltd.
Halifax—Brookfield Bros., Ltd.
Montreal—David McGill
Winnipeg—The Waite Fullerton Co., Ltd.
Saskatoon—The Waite Fullerton Co.
Vancouver, B. C.—The Waite Fullerton Co., Ltd.

Vertical Carbo Machine



One of the most efficient Machines we have ever made.

— *WE LEAD* —

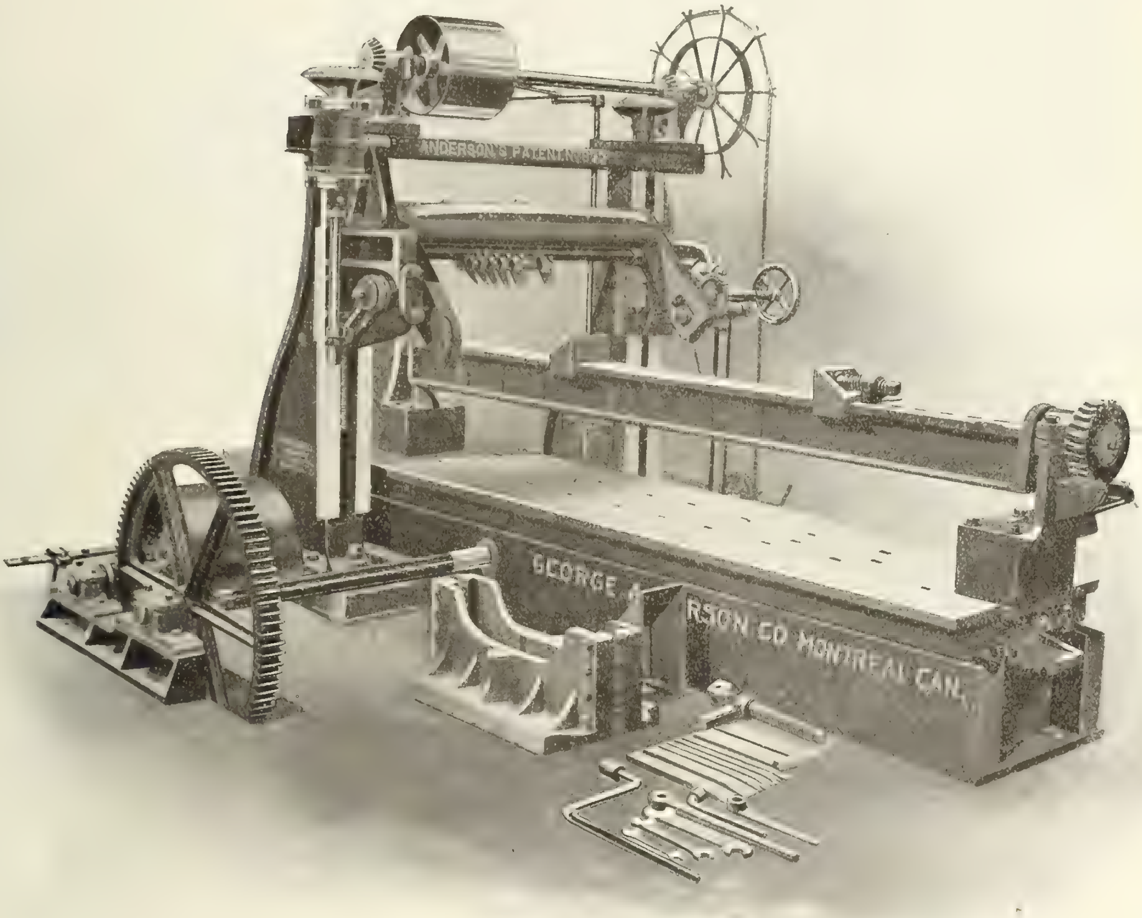
Stone Working Machinery

Geo. Anderson & Co. of Canada

Limited

Montreal, Que. and Carnoustie, Scotland

Anderson's Patent Reversible Planer—Slide Type


ANDERSON'S PATENT
GEORGE A RSON CO MONTREAL CAN.

Extensive experience shows that this Machine will do the work of at least eight men, and is easily 30% *faster* than the general types with single motion tables.

—OTHERS FOLLOW—

Cranes — Derricks

Geo. Anderson & Co. of Canada

Limited
Montreal, Que. and Carnoustie, Scotland

Brantford Collegiate Institute — Chapman & McGiffin, Architects, Toronto

Hamilton Pressed Brick

THIS high class product is made from a special hard shale, rich in iron oxide. The bricks are subjected to great pressure imparting to them almost a flint hardness.

The edges and corners of Hamilton Pressed Brick are always sharp and clean.

They are suitable for every class of brick work from fire-places to sky-scrapers.

A Hamilton Residence

**The
Hamilton
Pressed
Brick Co.,
Limited,
Hamilton, Ont.**

Athelma Apartments, Toronto. Mallory & Thatcher, Architects.

For Clean Fresh Work

NO effect is more permanent and pleasing than clean cut and fresh looking brick work. Such an effect may be obtained by the use of Hamilton Pressed Bricks. Their color is bright and their shape uniform and true.

FOR YOUR NEXT JOB SPECIFY "HAMILTON PRESSED BRICK."

The
Hamilton
Pressed
Brick Co.,
Limited,
Hamilton, Ont.

A Dunville Residence.

Don't Buy Sand Lime Brick At Random

SPECIFY

Harbour Brick Co's Product.

Reasons?

Made from—
Clean, pure Silica Sand,
Highest Grade Calcium Lime
By the
Best Equipment Procurable.

Results?

A Brick from outside to core,
Uniformity in Color and Size,
Consistency in Density and strength.

Read!

UNIVERSITY OF TORONTO
Faculty of Applied Science and Engineering

Toronto, December 21st, 1911.

The Harbour Brick Co., Limited,

Gentlemen:

Herewith find results of crushing tests, made on samples of sand lime brick as supplied by you. The size of the brick was 2¼ in. x 4 in. x 8 3/16 in.

Result of Crushing Tests

Designation	Area Sq. inches	Total load, lbs.	Ultimate crushing strength, lbs. per sq. in.
Half Brick No. 1	16	66,880	**4180**
Half Brick No. 2	16	64,330	**4020**

Yours truly,
(Signed) W. R. KEYS

Toronto, May 23rd, 1912.

Dear Sirs:

Below you will find a report of the tests made on two samples of Sand-Lime Brick submitted.

	Area under Compression	Ultimate Load	Ultimate Stress
Brick No. 1	36.2 sq. in.	147,100 lbs.	**4,050 lbs. per sq. in.**
Brick No. 2	36.3 sq. in.	150,150 lbs.	**4,130 lbs. per sq. in.**

Yours truly,
(Signed) ROBT. J. MARSHALL

Does not this establish our claim to consistency?

HARBOUR BRICK COMPANY, LTD.

50 Front St. E., TORONTO, ONT.

A THING OF BEAUTY AND A JOY FOR EVER

SILICATE BRICK

SILICATE BRICK or Sand and Lime Brick is produced by the chemical action of high grade lime combined with pure sand under a high pressure of steam. Pure sand, when brought into contact with hydrated lime and water under the influence of high temperature, produces a silicate of calcium. This compound, like all other silicates, becomes a very hard substance, and as the bricks grow older, the harder and stronger they become. Finally, under the influence of nature, the sand and lime of which they are made return to their natural condition of stone.

OUR OTTAWA FACTORY ON THE RIDEAU CANAL.

SILICATE BRICK is suitable for any purpose in which clay brick is used, but is far more durable and of better appearance. It has been tested and proved in the open market, with the result that the leading architects to-day are specifying Silicate Brick for all branches of building. The Silicate Brick Works of Ottawa was the first Sand and Lime Brick Plant in Canada. Since 1903, when the business was established, we have been continually making additions and improvements to our plant in order to meet the demand for Silicate Brick. OPEN YOUR EYES TO FACTS, and inquire further into the advantages of our product. Write for booklet—you will be interested in its contents.

SILICATE BRICK CO. OF OTTAWA, LTD.

OTTAWA, ONTARIO

HARRY F. ALLARDICE,
MANAGER

BERT W. CAMPSOLL,
SUPERINTENDENT

ESTABLISHED 1860

Watch Your Sewers

Be sure they are SANITARY. See that they are built of a material that will spell PERMANENCE. Demand a VITRIFIED CLAY PIPE that is not Porous, not Spongy, that can be easily Flushed. "A Sanitary Conduit that when Once Laid" will Last Forever.

Hamilton Vitrified Salt Glazed Pipe

gives you this assurance. Don't risk the HEALTH of your community by experimenting with any other product. It is too serious a question to be treated lightly.

The Hamilton & Toronto Sewer Pipe Co.
Limited
Hamilton and Toronto

Phone Hamilton—3990-3991

Phone Toronto—Adelaide 936

BIRD
NEPONSET
PRODUCTS

WINTER PROFITS

This winter you can do a nice business, building partitions, finishing off or remodeling rooms with

NEPONSET
WALL BOARD

You have probably seen our advertising to the House Owner in which we have already told them to "fix up their house this winter" with NEPONSET Wall Board. Remember this,—NEPONSET Wall Board is waterproof and finished. It does not require decoration. The whole job is yours.

Write for samples

BIRD & SON
(F. W. Bird & Son)

MAIN OFFICE:
16 Heinzman Bldg., Hamilton, Ont.

MILLS:
Hamilton, Ont., and Pont Rouge, Que.

WINNIPEG, MAN. ST. JOHN, N. B. MONTREAL, QUE. VANCOUVER, B. C.

VITRIFIED CLAY PIPE

Has No Equal

For SEWERS, CULVERTS,
or even FARM DRAINING

If you will always specify VITRIFIED PIPE "MIMICO" Brand will take care of itself.

NEVER RUSTS

NEVER DECAYS

Round Pipe and Square Dealings

SIZES 4" to 24" IN STOCK

PROMPT SHIPMENT ASSURED

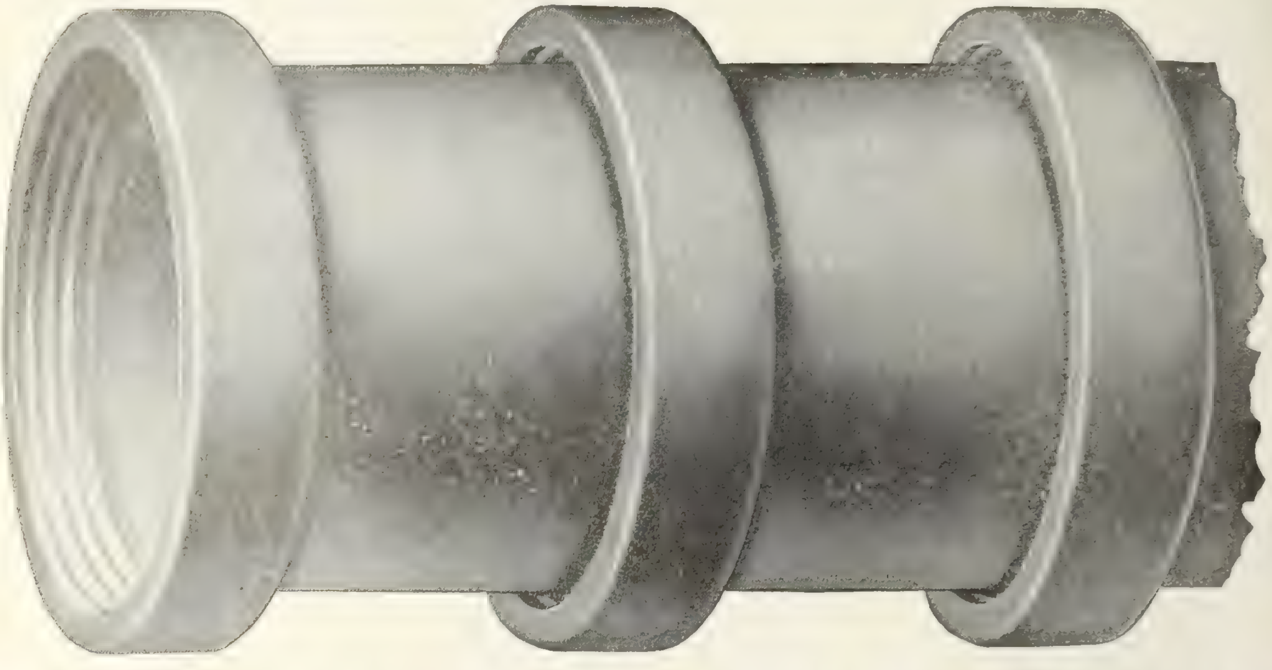
The Ontario Sewer Pipe Co., Limited

Mimico, Ont.

TELEPHONES—Toronto Connection, Park 422 — Evenings, Park 3888 and 3889

BIG BLACKMER PIPE MADE OF CLAY THAT IS PLASTIC IS STRONGER, LASTS LONGER, HAS A BODY ELASTIC

Sanitary *Economical* *Permanent*



SALT GLAZED VITRIFIED SEWER PIPE

OUR SPECIALTY IS LARGE SIZES—27, 30, 33, 36, 39 and 42 inch.

Sanitary Sewers

There are four essentials to a good sewer.

First—It must carry sewage quickly and surely to some point for final disposal.
The glassy smoothness of VITRIFIED PIPE enables it to do this.

Second—Its contents must not pollute the surrounding soil.
No sewage can escape through the walls of a VITRIFIED PIPE.

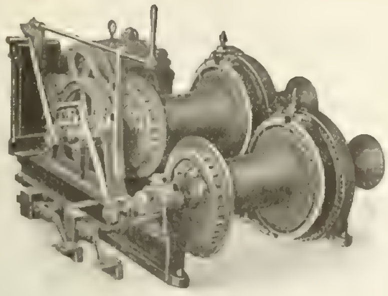
Third—It must prevent the ground water naturally present in the soil from entering the sewer.
VITRIFED PIPE is impervious.

Fourth—It must last indefinitely.
VITRIFIED PIPE never rusts, decays nor disintegrates.

Blackmer Vitrified Pipe covers these four essentials.

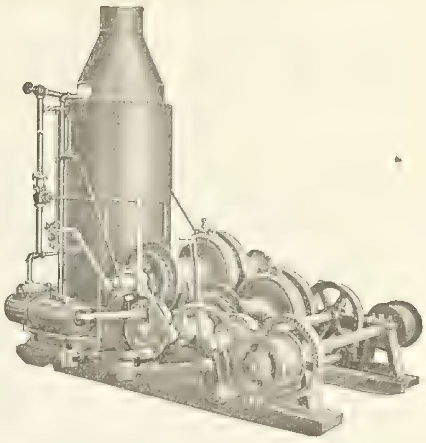
BLACKMER & POST PIPE CO.

ST. LOUIS, MISSOURI

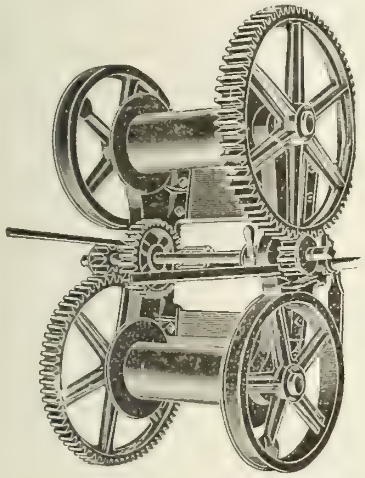


Electric Hoist

Double Drum Steam Hoist

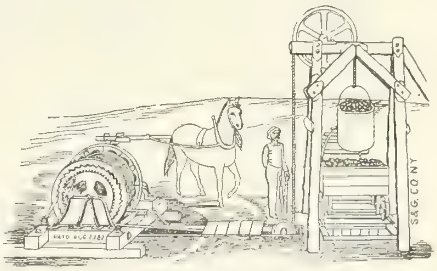


Double Drum Steam Hoists with Swinger



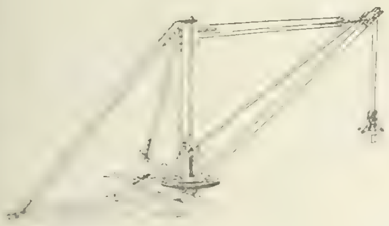
Double Drum Hand Power

BUFFALO
Hoists and Derricks are Known the World over

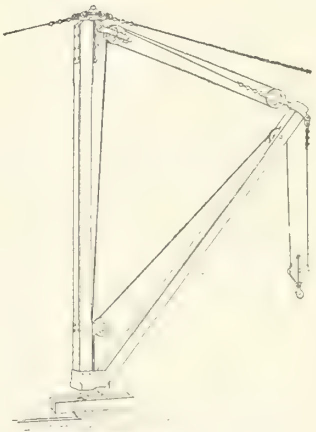


Miners Whim

We are Pioneer Manufacturers of Hoists and Derricks for any sort of work, having supplied Contractors and Builders throughout the World with equipment for 33 years. Should you have anything of a *Special* nature, our *Experience* and *Engineering* Department is at your command.



Stiff Leg Derrick



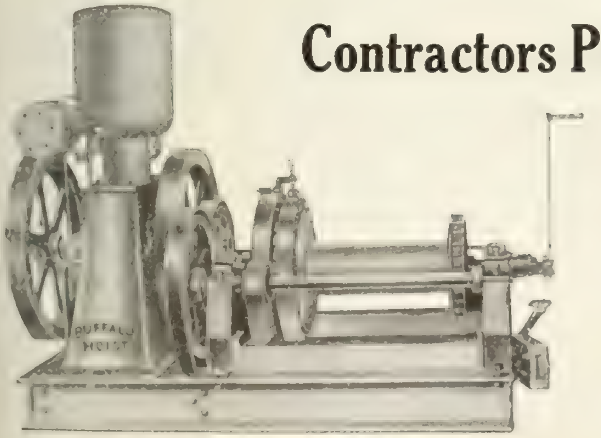
Guy Derrick

Contractors Plant Mfg. Co.

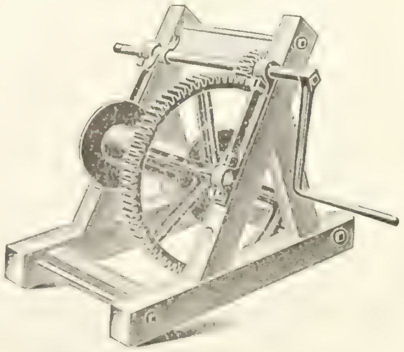
1-13 Henry Street

BUFFALO, N.Y.,
U. S. A.

Send for illustrations and quotations.



Gasoline Hoist



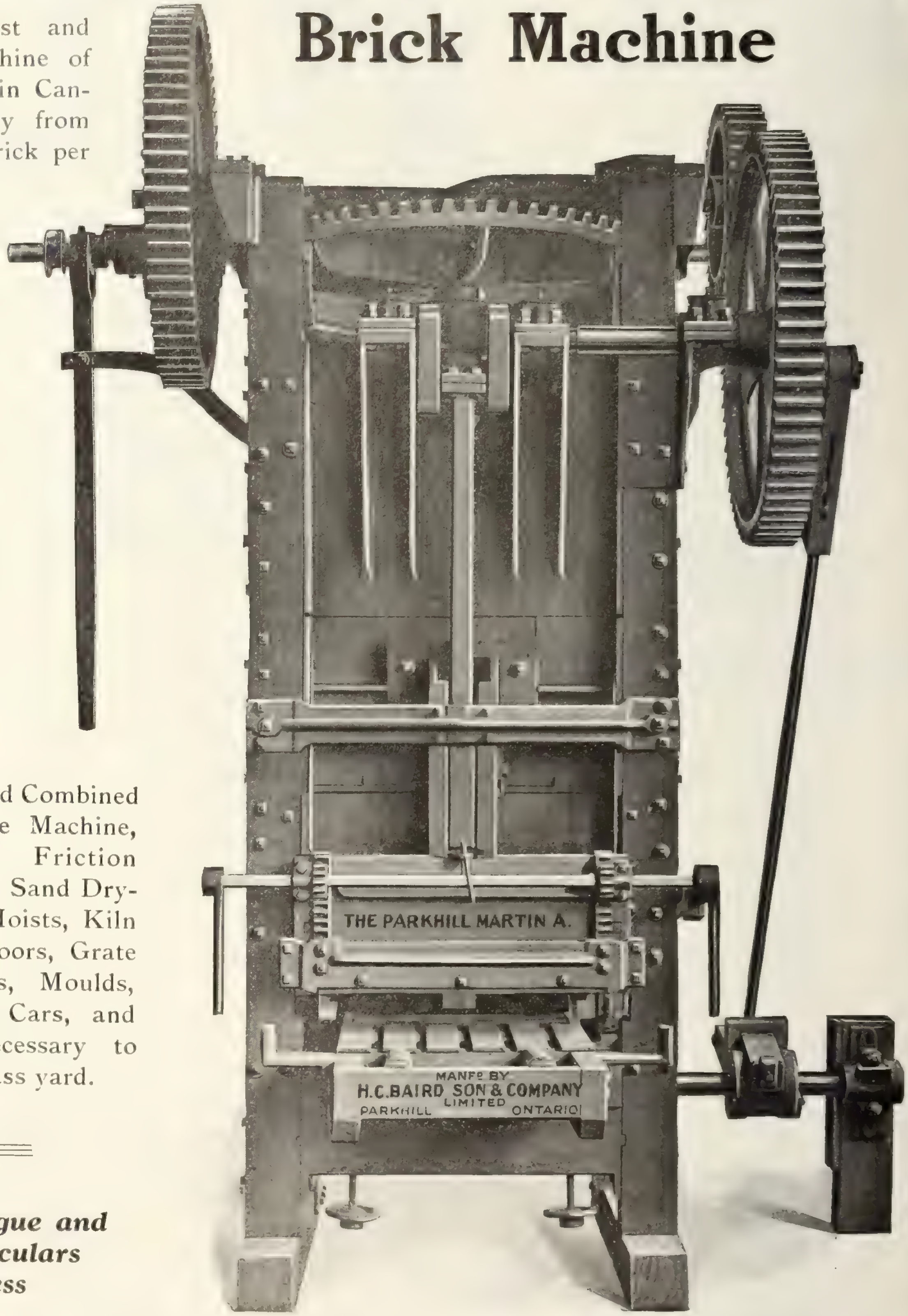
Single Drum Hand Power

PARKHILL MARTIN A

Brick Machine

The heaviest and strongest machine of its class built in Canada. Capacity from 20 to 50 M brick per day.

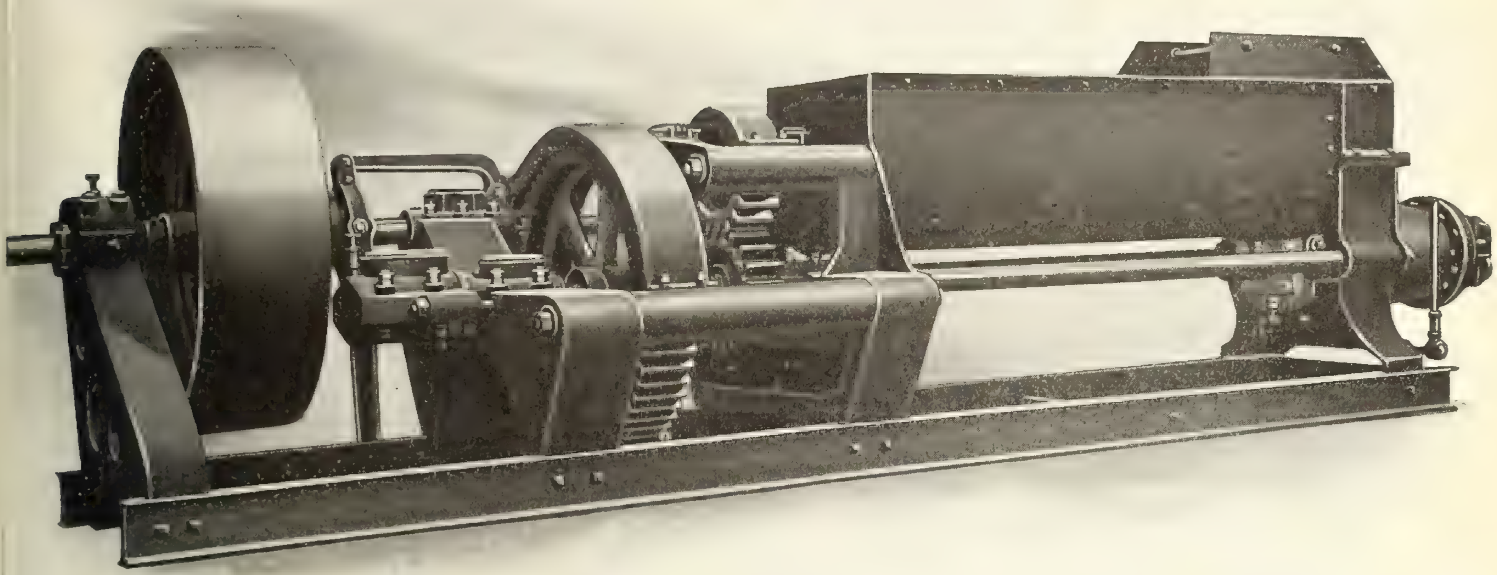
Pug mills, end or side delivery, either right or left hand side delivery, are driven direct from pulley shaft of Martin machine by a friction clutch pinion, making a positive and perfect drive.



Kells Patented Combined Brick and Tile Machine, Disintegrators, Friction Clutch Pulleys, Sand Dryers, Friction Hoists, Kiln Irons, Kiln Doors, Grate Bars, Barrows, Moulds, Trucks, Clay Cars, and everything necessary to equip a first class yard.

For catalogue and full particulars address

H. C. Baird Son & Co., Ltd. Parkhill, Ontario,
Canada



Dependable Brick Making Machinery

OUR Brick Machines are built in several types and sizes, suitable for an output of 10,000 to 150,000 brick per day. We have Machines and Cutters especially designed for drain tile, fireproofing, etc., and are prepared to furnish the entire equipment for modern plants of large or small capacity, for the manufacture of Building, Paving or Fire Brick, Drain Tile, Fireproofing, Electrical Conduits, Radial Chimney Blocks, and similar products.

The Union Machine shown above is an example of our heavy direct geared auger machine, with Pug Mill combined. Note the simplicity of the gearing arrangement and the design for convenient access to all working parts.

Our automatic Cutters have many points of advantage. They are built in two types, Rotating and Reciprocating, with several sizes of each. Adapted to the cutting of almost anything made on an auger machine, including the largest sizes of fireproofing.

We have complete testing facilities, and give careful attention to clay tests; also offer the services of our Engineering Department in the design of new plants, or re-design of old ones. Tell us your needs.

E. M. FREESE & CO. - Galion, Ohio, U.S.A.

Grand Trunk Round House, Mimico. The roofing on the above buildings executed by us.

Foundation of New C.P.R. Freight Terminals, Toronto. The Waterproofing on the above foundations executed by us.

The St. Lawrence Starch Company, Limited, Port Credit, Ont. The roofing on the above buildings executed by us.

LET US TENDER ON YOUR

ROOFING, WATERPROOFING AND FLOORING SPECIFICATIONS

We supply Roofing, Waterproofing and Insulating Materials of all kinds and undertake contracts for Roofing, Waterproofing, Tar-Rock and Mastic Asphalt Floors. Our complete equipment enables us to execute the work in accordance with Architects' and Engineers' Specifications.

CANADIAN SUPPLY AND CONTRACTING CO., LTD.

Structural Waterproofing Engineers and Contractors
220 King St. West, TORONTO, CANADA

Russell Shale Bricks

Made from

Red "Medina" Shale
Red Pressed Brick
Red Plastic Brick
Red Plastic Rustic Brick

THE Russell Shale Bricks are very hard and well suited to any work where an artistic effect is desired.

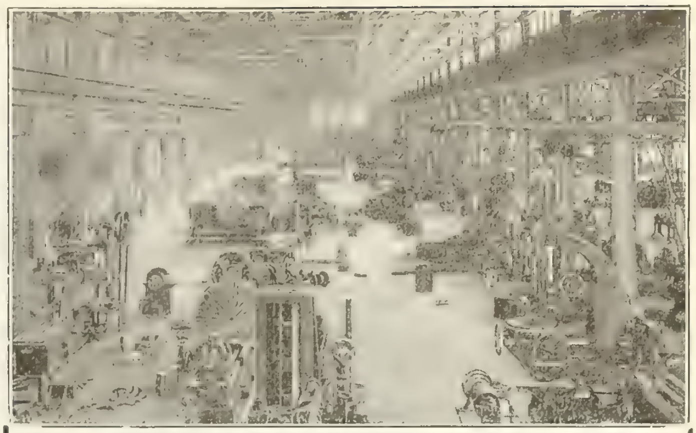
The brick burns to a rich, deep red tone.

The capacity of the Russell plant is 125,000 Bricks per day.

With four sidings in our yard we are able to make prompt shipments.

Write us

Russell Shale Brick
Limited
Russell, Ontario



Canadian Pacific Railway Locomotive Shop, Calgary, Alberta, Canada. J-M Mastic Flooring Applied.

Waterproofing Applied By Scientific Experts

Don't entrust an important job of waterproofing to inexperienced hands.

Satisfactory results can only be obtained by employing experts.

Our staff of engineers has successfully executed some of the biggest and most difficult waterproofing jobs. And you get the benefit of this experience and skill no matter how small your job may be.

J-M WATERPROOFING

does not dry out, chip, crack or run, because its base is pure natural asphalt—the most perfect waterproofing substance in existence. Ordinary waterproofing materials can't last long because they are composed principally of pitch and coal tar, which quickly dry out and go to pieces.

If you have a waterproofing problem to solve for a residence, business structure, church, bridge, abutment, reservoir or anything else, get in touch with our nearest branch. They will gladly co-operate with you.

Write for booklet.

THE CANADIAN
H. W. JOHNS-MANVILLE CO., LIMITED

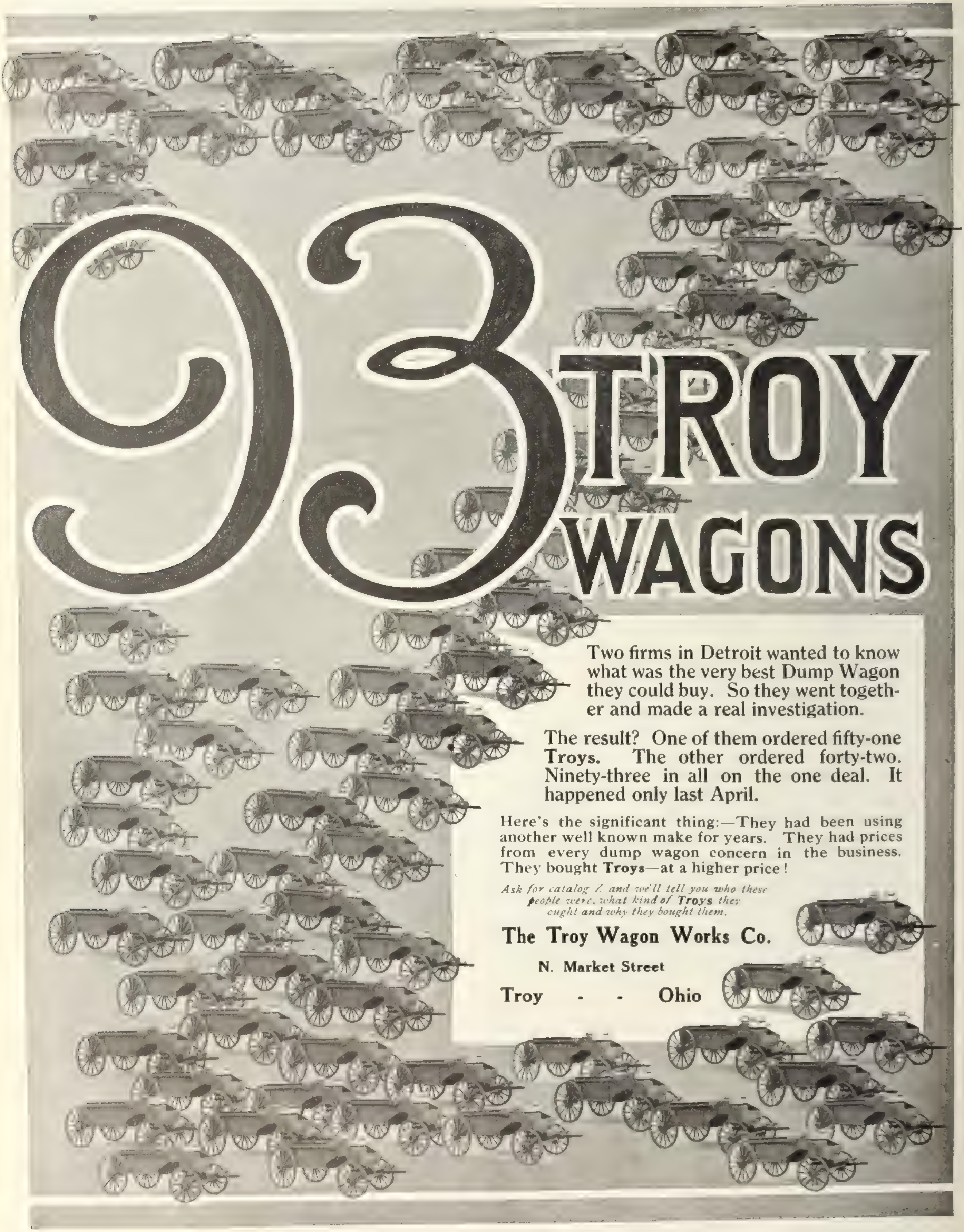
Manufacturers of Asbestos and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

2105



93 TROY WAGONS

Two firms in Detroit wanted to know what was the very best Dump Wagon they could buy. So they went together and made a real investigation.

The result? One of them ordered fifty-one **Troys.** The other ordered forty-two. Ninety-three in all on the one deal. It happened only last April.

Here's the significant thing:—They had been using another well known make for years. They had prices from every dump wagon concern in the business. They bought **Troys**—at a higher price!

Ask for catalog Z and we'll tell you who these people were, what kind of **Troys** *they bought and why they bought them.*

The Troy Wagon Works Co.

N. Market Street

Troy - - Ohio

A
C
D
F
No 2
MUELLER ORIGINAL WATER TAPPING MACHINE
H. MUELLER MFG. CO.
G
PAT'D
MUELLER
M

MUELLER No. 2 Machine

MUELLER WATER TAPPING MACHINES

for a great number of years have been acknowledged as the most efficient and economical tapping machines ever produced.

MUELLER tapping machines are made for every kind of service. They will either insert or extract a corporation cock or a brass plug in any kind of a water main and with the main under pressure.

MUELLER tapping machines are now made in Canada and every one Unconditionally Guaranteed.

Write for our liberal exchange proposition on your old machines

Clip the coupon below today and learn about our liberal exchange proposition, which we offer to companies with old tapping machines which have lost their efficiency. Send the coupon regardless of what make your machine is.

A few of the other MUELLER Products

Corporation Cocks
Curb Cocks
Compression Work
Rapidac Work
Fuller Work
Self Closing Work
Pressure Regulator
Strainers for all services
Brass Water Connections
Gas Tapping Machines
Meter Testers
Curb Boxes
Supply Pipes
Check Valves
Gas Cocks

H. MUELLER Mfg. Co., Ltd.

SARNIA, ONTARIO

U.S. Factory at Decatur, Ill., New York City, Chicago, San Francisco

**H.
MUELLER
Mfg. Co., Ltd.**
SARNIA, ONT.

*Gentlemen :—
Please send your exchange proposition on old tapping machine.*

Name ....

Address ....

GYPSUM HOLLOW TILE

The modern fireproofing material that is revolutionizing building construction.

ATHELMA APARTMENTS, TORONTO. *Mallory & Thatcher, Architects.*

All partitions in this building made with

Gypsum Hollow Tile

All plaster used was

Anchor Hardwall Plaster

All walls Finished with

Gypsum No. 3. Grey Finish

Gypsum Hollow Tile is very light, weighing less than half as much as clay tile, therefore you save on your structural steel, etc. It does not expand under intense heat, is not warped and forced by the fireproofing, costs less by far than the ordinary clay hollow tile, and gives sound, heat, cold and fireproof walls.

Gypsum Fireproofing is made in blocks containing 2½ square feet, which affords speed in erection, gives greatest rigidity to the walls, contains no silica or sand, can therefore be sawed and fitted. It holds nails and screws, is a wonderful heat retarder.

Anchor Hardwall Plaster is a gypsum plaster mixed with proper proportions of sand, fibre, etc., and requires the addition of water only, to make it ready for instant use. It's always uniform, sets quickly and hard, no cracking or checking.

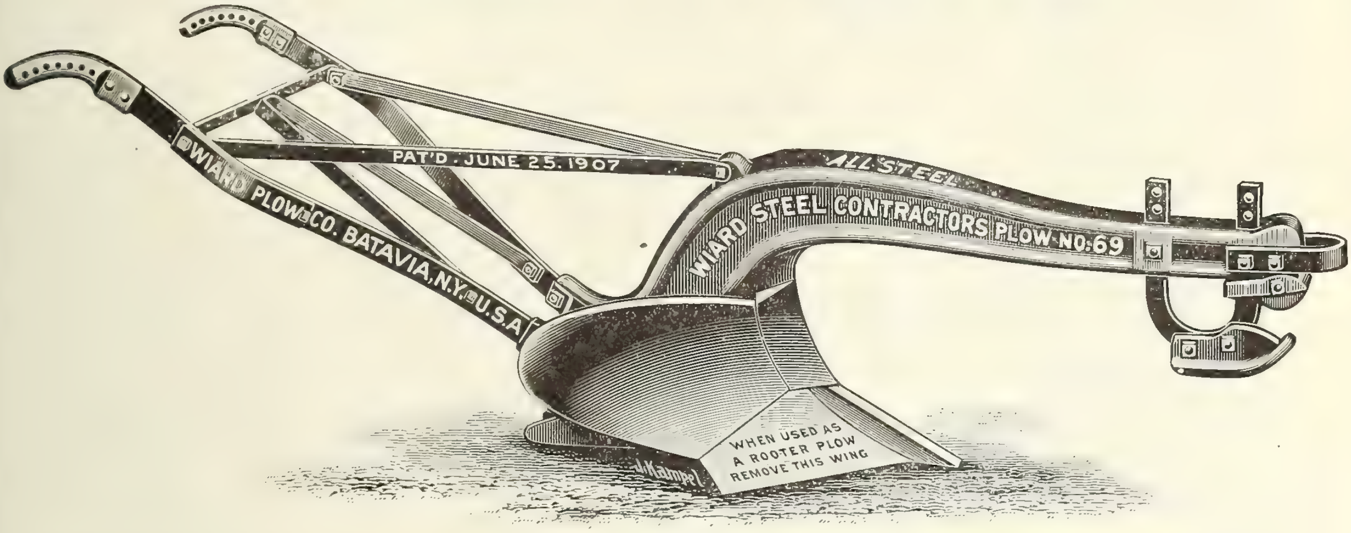
Gypsum Ready Wall Finishes make hard and durable surfaces that are quickly and easily applied, and are a guarantee against checks, pitts, cracks, etc. They are ready for use and require water only.

We are specialists in the manufacture of Gypsum Fireproofing and Hardwall Plasters and Finishes. Get our specifications and prices.

Alabastine Hardmortar, Limited

123 Bay Street, TORONTO

The Strongest Plow in the World


PAT'D. JUNE 25. 1907
ALL STEEL
WIARD STEEL CONTRACTORS PLOW NO. 69
WIARD PLOW & CO. BATAVIA, N.Y. U.S.A.
WHEN USED AS A ROOTER PLOW REMOVE THIS WING

The Wiard Contractor's Plow No. 69 is a perfect combination Turning and Rooter Plow

The Cast Steel Beam is amply strong for all use with animal or traction power.

The heavy Reversible Steel Point forms the lower part of Landside.

It is securely held in place by bosses of the steel Beam that fit the countersunk bolt holes, which prevents all strain on or Shearing of bolts.

To make a complete Rooter Plow, remove the wing as shown in large engraving.

Note the very heavy steel Moldboard, the heavy and strongly braced Steel handles and all other attachments.

ALL STEEL
WIARD STEEL CONTRACTORS PLOW NO. 69
PAT'D JUNE 25. 1907
WIARD PLOW CO. BATAVIA, N.Y. U.S.A.

Landside view of No. 69 Plow with Reversible Point

Four other sizes of Contractors' Turning and Rooter Plows with Steel or Iron Beams.

Ask for special circulars of the greatest line of Contractors' Plows ever offered.

WIARD PLOW COMPANY

BATAVIA, N. Y., U. S. A.

Luxfer Prisms

WITH the ever increasing congestion of buildings comes the demand for a solution to the problem of daylight.

The solution is Luxfer Prisms by means of which daylight may be thrown into dark offices and warehouses, etc.

The experience of our refractionists is at your disposal. Write us.

Luxfer Prism
Company, Limited
Toronto

Renfrew Lime

Brick, Drain Tile or Weeping Tile

SHIPPED PROMPTLY

to any part of the world

Renfrew Lime is recognized by builders and contractors as the best building lime on the market.

Reasons Why

It takes more sand.

It trowels easily, and mortar requires less tempering on the board. This enables bricklayers to do more work.

The saving pays for the lime.

We Manufacture

High-Grade
Lime,
Brick,
Drain Tile

Send us
your next order.

PHONE 49

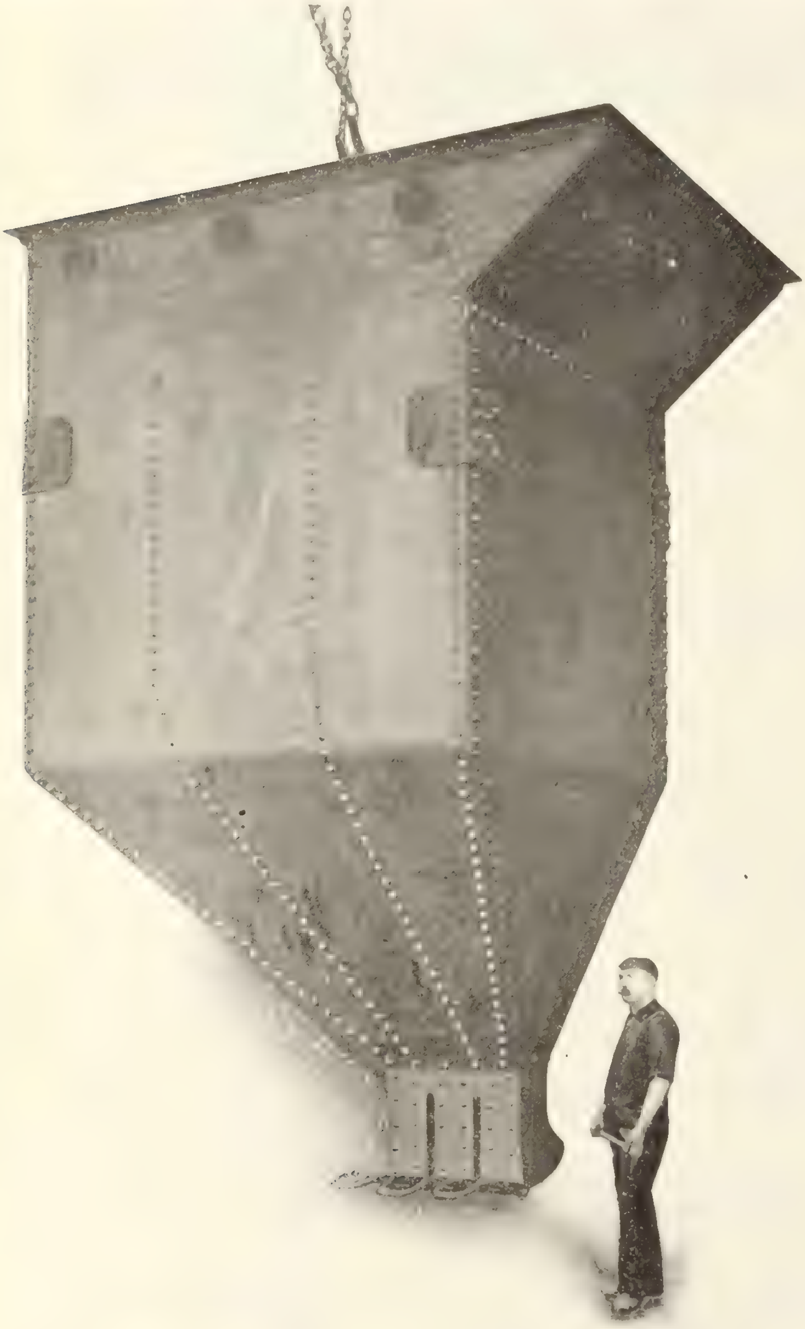
We can supply High-Grade Lime on shortest notice for the manufacture of

Carbide
Chemical
Products,
Sand,
Lime,
Brick.

Jamieson Lime Co.

RENFREW, ONT.

STEEL PLATE Tanks and Bins



WHEN next you want a well built Steel Tank or Bin of any kind—write us.

We are doing a lot of this work just now and have thereby so reduced our manufacturing costs that we are able to offer you a high-class product in this line at prices that are unusually attractive.

We build, in all sizes:—

PRESSURE TANKS
STORAGE TANKS
SETTLING TANKS
WASHING TANKS
STORAGE BINS
ALSO
STEEL BUCKET ELEVATORS
STEEL BUCKET CONVEYORS
STEEL TROUGHING
RIVETTED STEEL PIPE

Send us your sketches for quotation. We specialize in turning out difficult steel plate work—built right, at a reasonable price.

Some of the larger jobs we have recently handled are illustrated in our Booklet No. 400. A post card will bring it to you.

The Waterous Engine Works Co., Limited

Vancouver, B. C. BRANTFORD, CANADA Winnipeg, Man.

Victorian Pedestal Lavatory No. 857.

Victorian Lavatory No. 801.

Victorian

Vitreous-China

Lavatories

are strictly sanitary fixtures, designed upon simple lines and have neatly rounded surfaces, having no crevices to permit the accumulation of dust or grit.

They are constructed of the highest grade semi-porcelain vitreous ware throughout, with a hard glazed finish which gives a permanent rich glossy effect that will never craze,—commonly termed "lime cracks".

Made in several designs to suit all locations. Suitable for the modern Bathroom or Washroom, and particularly adapted for tile finished rooms.

Lighting Fixtures

We invite your inspection of our Lighting Fixtures at our Showroom, 93 Adelaide Street West, or shall be pleased to mail you Catalogue showing a partial variety of our designs.

Estimates and designs submitted of Fixtures for Private Residences, Apartment Buildings, Office Buildings, etc.

As Manufacturers we can save you money on your Lighting Fixture requirements.

Manufacturers of Brass Rails for all purposes. Altar Rails, Office and Store Rails, Ticket Wicket Rails, &c.

Estimates submitted upon request

The James Morrison Brass Mfg. Co., Limited

Toronto, Ont.

Royal Bank Building
Toronto

To be fireproofed with Don Valley Porous Terra Cotta Fireproofing.

The New Royal Bank Building Toronto

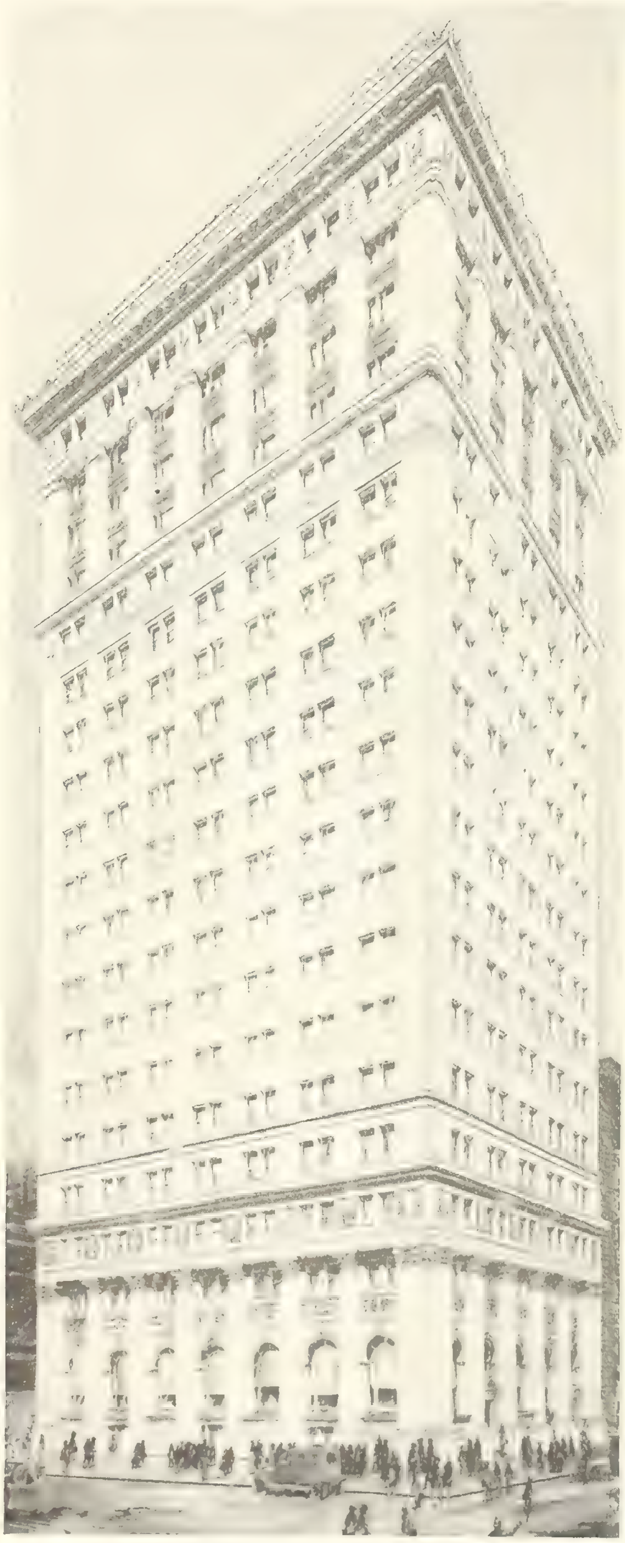
BECAUSE of performance in actual fires, because of its great strength and because we are able to ship any quantity promptly, Don Valley Porous Terra Cotta Fireproofing was selected from a host of competitors as the best material with which to fireproof the the new Royal Bank Building, Toronto.

Don Valley Brick Works, Toronto

Don Valley Porous Terra Cotta Fireproofing

THE new Royal Bank Building will be one of the finest office buildings in the British Empire. Don Valley Bricks will be used extensively in the interior construction and the award to us for the Porous Terra Cotta Fireproofing is the largest fireproofing contract ever let for a single building in the British Empire.

Always specify "Don Valley Clay Products."



Royal Bank Building
Toronto

To be fireproofed with Don Valley Porous Terra Cotta Fireproofing.

Don Valley Brick Works, Toronto

A Direct Question

If you could get a Free Tool that would save you hours of hard work and many dollars on every job, how long would it take you to write for it ?

The Answer

You can get a Monarch Patent Cornice Mould on an absolutely **Free Trial** for **five** days. Use it as much as you want to. Make plaster cornices in your own home or in the homes you are building. **Five Days' Free Trial** and it does not cost you a cent. If you don't want to buy the Cornice Mould, that's your business.

If you do want to buy it, that's my business to sell you one at a moderate price or on easy monthly payments to suit your convenience. Pay for the tool out of its earnings.

Complete Set Consists of Blade Holder, 10 Blades and Blade Scraper

The MONARCH CORNICE MOULD

consists of an aluminum frame fitted with the best red birch guides and black cherry handles. It is light and strong. Ten assorted blades and a blade scraper complete the set. Each blade is made of white pine. The edge is of zinc encased in the wood. The pine is specially treated so plaster or water will not affect it. This tool will make straight cornices and perfect corners quicker, easier and better than you have ever seen it done. The saving in time is wonderful and the work beyond comparison. It requires no special skill to use this Cornice Mould. You can handle it as well as I can.

Don't send one cent of money. Just send me your name and address. Tell me you want to try the Monarch Patent Cornice Mould on my FREE OFFER. I'll send it to you charges prepaid. If you don't want to buy after giving it a fair trial, send it back at my expense.

A Fair Proposition for Square Men. Write Today.

Timothy F. Horan

10 Maple Street, COOPERSTOWN, N.Y.

Send No Cash——Mail The Coupon

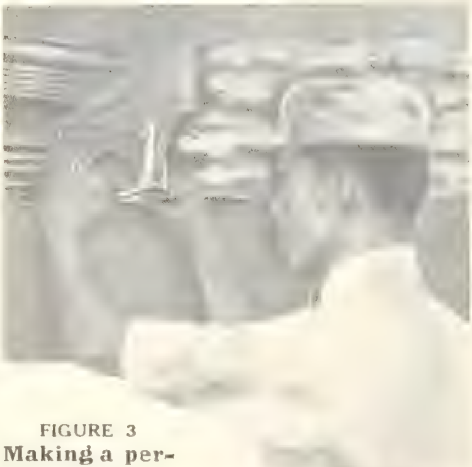


FIGURE 3
Making a perfect corner.

SPECIAL FREE TRIAL COUPON

Timothy F. Horan,
10 Maple Street,
Cooperstown, N.Y.

Dear Sir:—You say the Monarch Patent Cornice Mould does perfect work. Prove it. Send the mould on Five Days' Free Trial. You are to pay transportation charges. If I don't like the mould I don't have to keep it. If I decide to buy it, I agree to pay you $30 which is the net price $50 less 40 per cent. discount. or else I'll pay you $3 a month for 11 months.

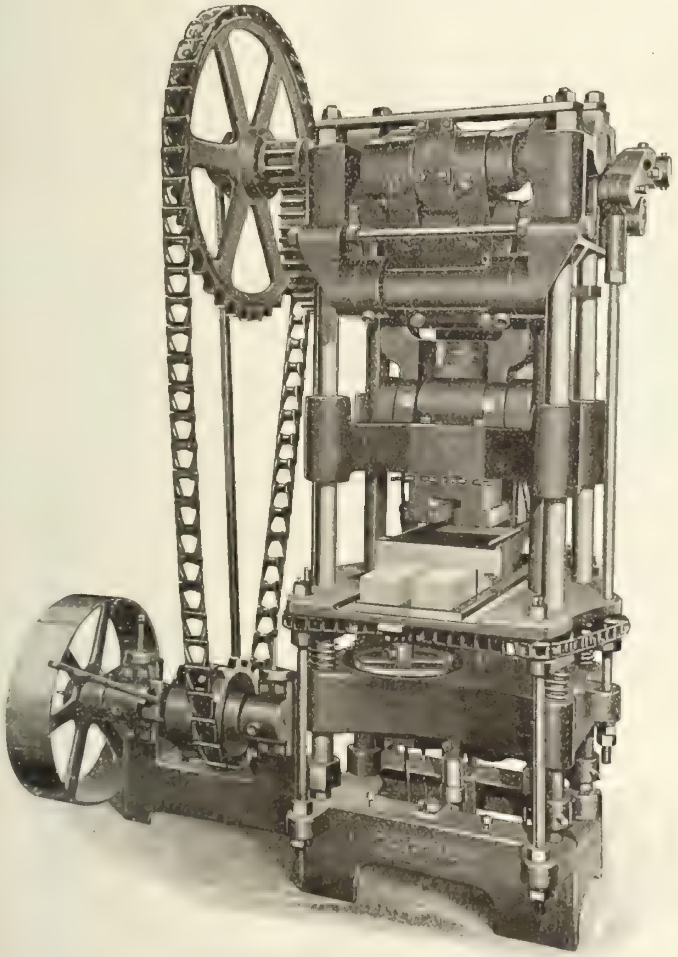
Name ....

Address ....

Town and State ....

WETTLAUFER

Brick Machinery



The new Wettlaufer Brick Press has caused astonishment and admiration among Brick manufacturers, by reason of the wonderful range of work it covers in the manufacture of Cement, Lime and Clay Brick. The enormous pressure which this machine produces has been the cause of raising the crushing strain, particularly of the Cement Brick, to a maximum of 5000 lbs. per square inch over the ordinary Clay Brick. This has been accomplished by the ability of the machine to put the material under an estimated pressure of 2000 to 4000 lbs. with a Double Repress. This Double Repress eliminates all possibility of there being any voids in the bricks. The Wettlaufer Brick Machine is also fitted with adjusting Dies and Table, enabling the operator to change instantly the thickness of the brick from 1" to 3½", giving him choice of any size between the two extremes. The capacity of this machine is 15000 per ten hours, the power required to run the press being from 4 to 5 H. P.

This press is another addition to the big line of Wettlaufer concrete machinery.

We invite you to attend the daily demonstration at any of our branches

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

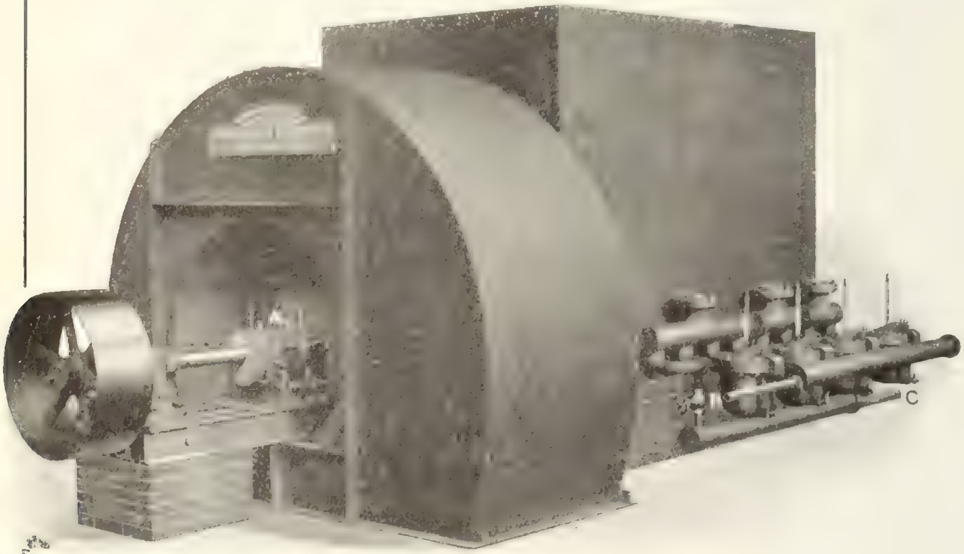
AGENCIES:

A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L Lachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagauchetiere St. W., Montreal.

THE AMERICAN CLAY MACHINERY COMPANY
BUCYRUS OHIO USA

Burning and Drying

The Haigh Continuous Kiln and the Bucyrus Waste Heat Dryer insure great economy whether used together or independent of each other. The Haigh Continuous Kiln is particularly adapted for burning all kind of clay products. Because of the advantageous principles embodied in the Haigh Kiln, your products can be more economically burned than in any other kiln. The economy applies not only to the fuel required but also to the high percentage of No. 1 Product and the economy in handling the ware in and out of kiln. The advancing heat feature of the Haigh Kiln makes it possible to burn a kiln with not over sixty per cent. of the fuel required in other kilns and the finished product is much superior. The Haigh Kiln is in daily successful operation on hundreds of yards. Persons interested will be furnished names of satisfied users of the Haigh Kiln. Plans and estimates of this best of all burning systems will be furnished.

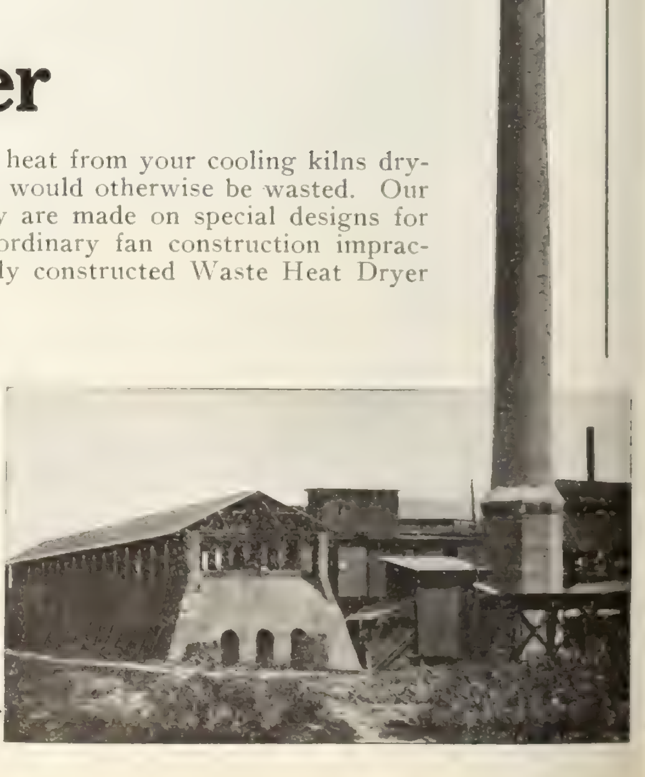


Waste Heat Dryer

With our Waste heat dryer apparatus we take waste heat from your cooling kilns drying your product quickly, thoroughly and with heat which would otherwise be wasted. Our fans are best for the Waste Heat Dryer work because they are made on special designs for just that work. The hot gases from the kilns make an ordinary fan construction impractical and expensive to the operator. We have our specially constructed Waste Heat Dryer apparatus which means greater return for the investment and an increased capacity and quality.

We build every machine and appliance for making all kinds of clay products.

Our steam shovel will save in Clay Pit. It is designed especially for the Clay Worker. Catalogues of any apparatus on request.

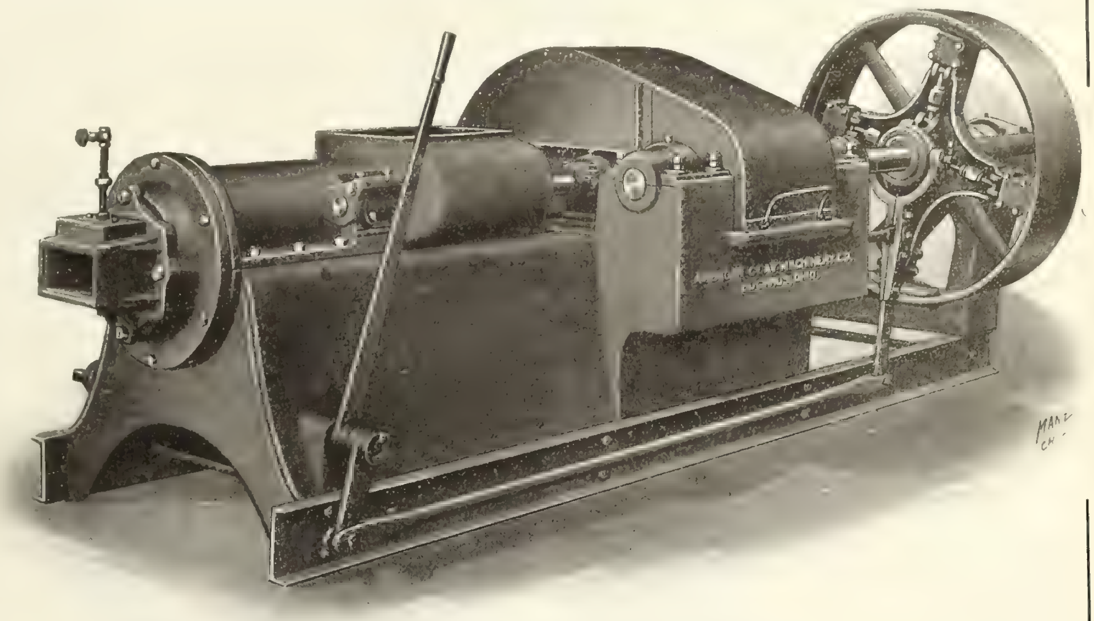


The American Clay Machinery Company
BUCYRUS, OHIO

THE AMERICAN CLAY MACHINERY COMPANY
BUCYRUS OHIO USA

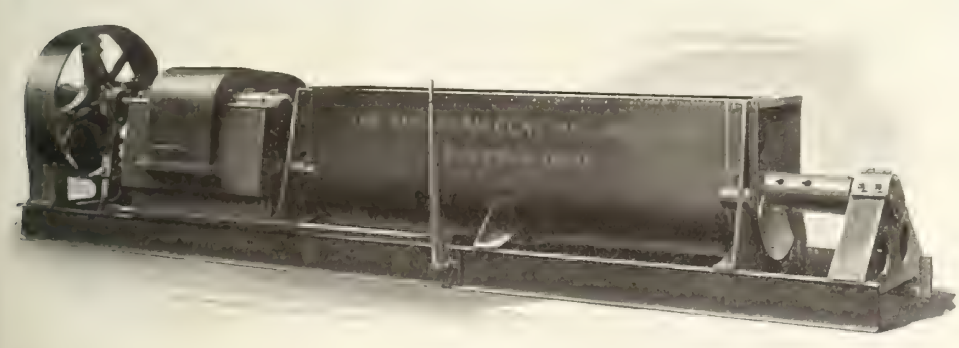
No. 233 Auger Machine

One of our new machines built for economical production of building and paving brick, tile, hollow ware and fireproofing. Capacity per hour on average material: Building brick 3,000 to 5,000 per hour. Paving brick, 2,000 to 3,500. Drain tile, 4-in., 2,000 to 3,000; 6-in., 1,500 to 2,000; 8-in., 1,200 to 1,500; 12-in., 600 to 1,000. Fireproofing and hollow ware 7 to 12 tons. Base is a heavy one-piece casting carrying bearings and oil reservoirs for gears and lower half of clay cylinder. Auger shaft turned forged steel. Bearings ring oiling and babbitted, 8 to 12 inches long. Ten inch self aligning thrust bearing. Gears cast from American gear metal, gears run in oil. Continuous auger with chilled wearing surface. Clay cylinder has sectional liners, removable. Tapered sectional liners around expressing auger. Hopper feed 8 in. diameter with reversible spring steel blades. Friction clutch pulley. Full description on request.



No. 304 Pug Mill

Here is a single shaft geared pug mill of easy running and great capacity. Can be driven in either direction and discharge at either end. Building brick capacity 4,000 to 8,000. Paving block 2,500 to 5,000. Capacity is governed by speed, pitch of knives and nature of material and tempering required. The base is a heavy one-piece casting carrying bearings and oil reservoirs for gears to run in oil. Cast iron eight inch tempering shaft. Knives hammered steel, battle ax type, can be set at any angle. Bearings ring oiling babitted 12 and 16 inches long. Shell is one piece tank steel 5/16 thick, 120 in. long, 28 in. wide, 33 in. deep. Friction clutch pulley.



This is a mill that will make good. Full description for asking.

We build every machine required in a clay plant. For description of other machinery read the American Clay Magazine, Bucyrus, Ohio, free to clay workers.

The American Clay Machinery Co.

BUCYRUS, OHIO

Rust Resisting - Anti-corrosive - Copper Bearing Sheets

Apollo Keystone Copper Bearing Galvanized Sheets

and Keystone Copper Bearing Steel Sheets

AMERICAN SHEET & TIN PLATE CO.
APOLLO
BEST BLOOM
TRADE MARK REGISTERED
KEYSTONE

The greatest improvement in Sheet Metal for years; we now offer you the most serviceable Sheets that can be produced.

The first cost of these Sheets is but a little more than ordinary Sheets, but they last so much longer that it is much more economical in the end.

AMERICAN SHEET & TIN PLATE CO.
APOLLO
BEST BLOOM
TRADE MARK REGISTERED
KEYSTONE

Send for our special booklet with the photographic illustrations of **Actual Weather Tests** showing how much greater durability Copper Bearing Steel has over ordinary steel.

United States Steel Products Company

NEW YORK, U. S. A. Branch Offices: Winnipeg and Vancouver

SELLING AGENTS FOR EASTERN CANADA:

B. & S. H. THOMPSON & CO., Ltd.

Transportation Building, MONTREAL. Traders' Bank Building, TORONTO

New Plant of Frontenac Floor and Wall Tile Company, Limited, Kingston.

Floor and Wall Tile "Made in Canada"

With our new and complete plant and excellent raw materials we are able to offer floor, wall and decorative tile equal to the imported product.

Architects and engineers may execute their most elaborate ideas in decorative and other tile without depending on a foreign product and delayed shipments.

Our shipping facilities are excellent having connections with both C. P. R. and G. T. R.

We will be pleased to submit prices.

Frontenac Floor and Wall Tile Company, Limited

Kingston, Ontario

Enamel Concrete Brick

Concrete as a building material has long been admitted to be the most durable of all. **The Enamel Concrete Process** adds the one element necessary to make it perfect, i. e., beauty. The brick can be faced in any color of shade desired.

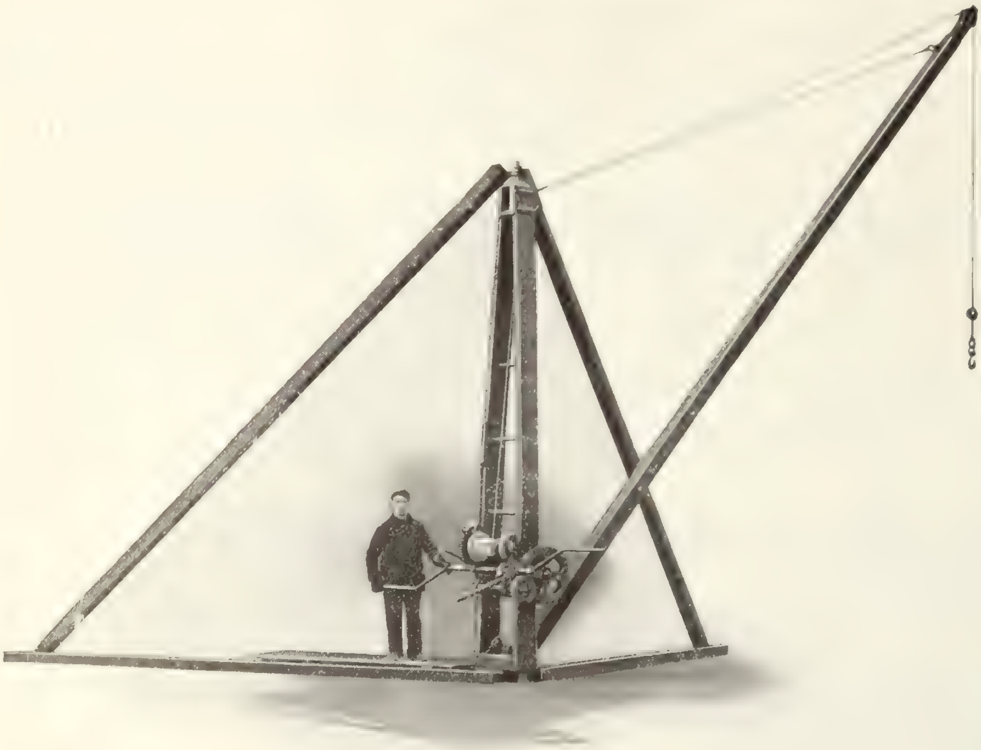
Enamel Concrete Brick has been tested and examined by leading architects and engineers throughout Canada and the United States. It stands a greater test for strength and fireproof quality than clay brick and grows stronger with age.

The facing which is amalgamated with the backing under enormous pressure, is impervious to moisture and will rainwash, requiring no cleansing even in the lighter tints after the brick is in the wall.

The National Builders' Supply and Enamel Concrete Brick Co., Limited

Office
30 St. Francois Xavier St., Montreal

Factory
St. Henri de Mascouche, P.Q.



Beath Derricks

Hand, Electric, Steam

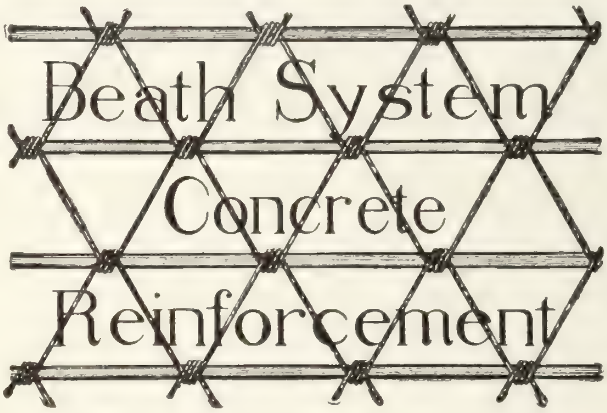
Trenching Machines

We make Derricks any capacity, any length Boom, Timber or Steel Construction. Tell us your Derrick needs and let us quote you on the Best Derrick Equipment obtainable.

The Highest Degree of Concrete Efficiency

is attained by the use of

Beath Steel Bars



Detail of Reinforcement. Style No. 23

Woven Wire Mesh

We could give argument upon argument to bear out the above statement, but what you want is "proof," and that is evidenced by the large orders being placed for this class of Reinforcement, and the representative firms who have adopted it.

Use "BEATH SYSTEM" Concrete Reinforcement

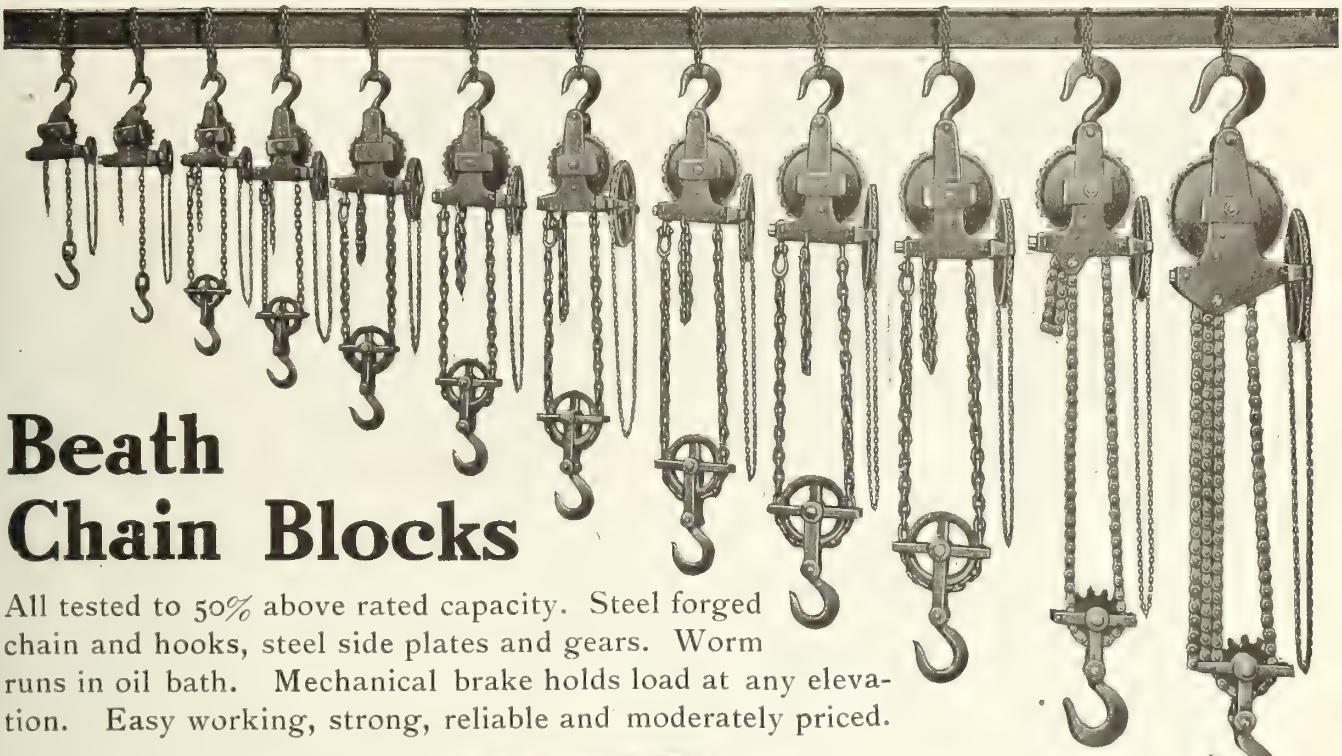
WIRE FABRIC for Floors, Roofs, Bridges, Dams, Sewer Pipe, Retaining Walls
BEATH BARS for Beams, Columns and Girders.

Write us for further particulars today

W. D. BEATH & SON, LIMITED

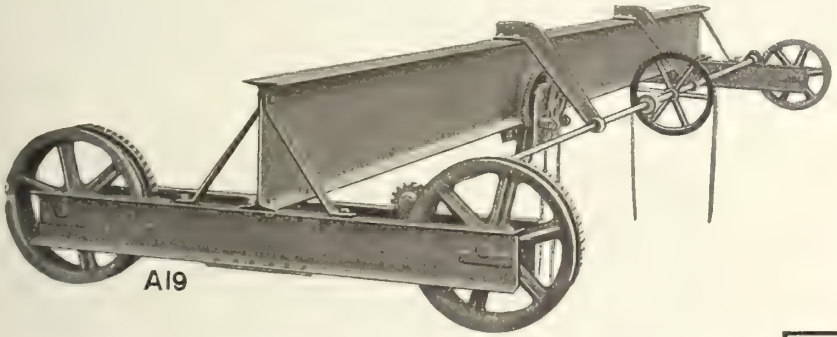
20-30 Cooper Avenue, TORONTO, CANADA
The A. M. Ellicott Co. Montreal, Agents, Province of Quebec

BEATH HOISTING MACHINES



Beath Chain Blocks

All tested to 50% above rated capacity. Steel forged chain and hooks, steel side plates and gears. Worm runs in oil bath. Mechanical brake holds load at any elevation. Easy working, strong, reliable and moderately priced.

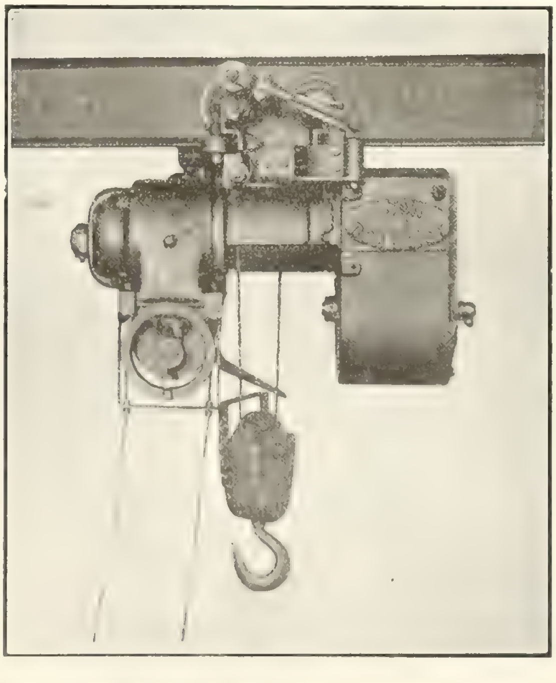


Electric Hoists

For rapid, easy hoisting and traveling Beath Box Electric Hoists give highly satisfactory service. Equally suitable as Portable Hoists, Crane and Runway Hoists and Travellers. Built for any capacity up to ten tons.

Beath Hand Power and Electric Cranes

We build a wide range of Hand Power and Electric Cranes suitable for any service. Above Crane of 7½ tons capacity 30′ span supplied the Edmonton waterworks two years ago. We have a large number of these and other types of cranes in satisfactory service all over Canada. Let us estimate on your hoisting and conveying requirements.



W. D. Beath & Son
Limited
20-30 COOPER AVE., TORONTO, ONTARIO
The A. M. Ellicott Co., Montreal
AGENTS, PROVINCE OF QUEBEC

Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs.

Careful attention to details and thorough workmanship have made Meadows' stair work popular.

QUOTATIONS FURNISHED.

The GEO. B. MEADOWS
Toronto Wire, Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.

"EBANO" and "EAGLE" Brands

MEXICAN ASPHALT

HERKIMER ST., HAMILTON. Paved with our Mexican Asphalt.

Write for analysis and samples

The
Asphalt & Supply Company, Limited
Sole Canadian Agents for the Mexican Eagle Oil Co.
Also Agents for MASTIC ASPHALT for Sidewalks.
428 Transportation Bldg., MONTREAL

Every Engineer

Electrical News
Generation Transmission and Application of Electricity

should read the Electrical News. Twice a month it tells of the latest development in connection with electrical power plants and new apparatus. It contains illustrated descriptions of big installations in every part of Canada. It tells of ways and means to improve your plant and to effect savings in operating costs. In short, it is full of information which is helpful to every engineer operating a plant in which electricity is used.

Sample copy for the asking.

Published Semi-monthly
$2.00 per year.

ELECTRICAL NEWS
220 King Street West
TORONTO

Sproatt & Rolph
Architects, Toronto

House for Nurses
Woodstock General Hospital
Woodstock, Ontario

Faced with
Hy-tex Bokhara Brick

There is one name by which you can identify QUALITY in every kind and style of the most desirable material for outside walls. It is

Hy-tex Brick

You want a brick you can identify—the maker's name makes him directly responsible to you. And Hy-tex is the only name which stands for universal quality in brick—and for that only.

All other brick trade-marks mean some one color or some one texture. The Hy-tex trade-mark means simply best brick. And there's a Hy-tex brick in every color and every texture known to brick-burning.

Somewhere in the Hy-tex line
there is just the Brick you want.

HYDRAULIC-PRESS BRICK CO.

AGENTS IN EASTERN CANADA

Alex. Bremner, Limited
Bleury Street, Montreal

Pruneau & Cie
140 Rue St. Pierre, Quebec

Black Building Supply Company
Mail Building, Toronto

W. A. Freeman Co., Limited
Hamilton, Ontario

A Continuous Kiln for $3,000

The KLOSE Continuous Kiln for Burning

Brick and Tile

Will produce merchantable ware at a fuel and labor saving that cannot be exceeded.

Building Tile is the Common Sense Building Material, fireproof, non-conductive and inexpensive.

Tile are more profitable than brick to manufacture, because they require less clay—hence less labor, fuel, power, freight, etc., for an equal displacement of wall.

ONE TON OF TILE EQUALS TWO TONS OF BRICK

Years of Experience Manufacturing Brick and Hollow Tile Well Qualifies Us to Design Your New Plant or Remodel Your Old Plant.

The Denison Ceramic Engineering Co.

8th Floor Hippodrome Building, CLEVELAND, OHIO, U. S. A.

Write for information on Klose Kiln and Dividend Paying Brick or Tile Plant. We do not manufacture or sell machinery.

THE BRICK BEAUTIFUL

Tregil
Brick

**Rough or Smooth
in All Shades of**

RED
BROWN
GREY
GREEN

**Stiff Mud
Vitrified**

**Panel exhibited in the Made in Calgary Exhibition, admired by thousands.
Built of Tregil Rough Face Brick in the Red and Brown Group.**

Tregil
Brick

**Rough or Smooth
in All Shades of**

RED
BROWN
GREY
GREEN

**Stiff Mud
Vitrified**

EDMONTON
304 Alexander Bldg.

Tregillus Clay Products Ltd.

REGINA
3 Banner Building

Head Office, 438 Lougheed Bldg., CALGARY, ALTA.

John Deere Plow Co.

of Welland, Limited

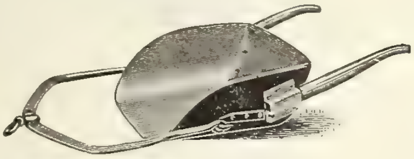
77-79 Jarvis St. TORONTO

INVITE YOUR INSPECTION

of

Their Popular Line of

Scrapers

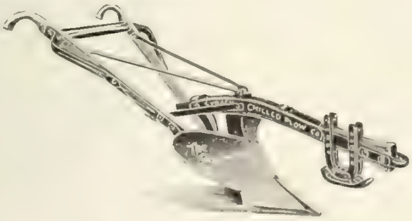


Barrows

Pick Plows

Contractors Plows

and



Watson Dump Wagons

Ultimately

a community always comes back to vitrified clay pipe for sewers. Cities, like scientists, try experiments. Cities, like sightseers, take interest in new things. Brooklyn spent a lot of money experimenting with new kinds of sewer pipe. Now she is back to vitrified—the biggest she can buy on the market. Worcester, Mass., also experimented and came back. Milwaukee is still experimenting—and replacing disintegrated concrete pipe only 60 days old. Los Angeles has her old disintegrated sewers as a result of her experiments, and in San Diego two years ago the air was full of injunctions against so called "glazed" sewer pipe. As a matter of fact, there is only one material ever manufactured for sewers that can stand the acids of sewage and the alkali of soils, that is fire-glazed like porcelain and therefore impervious to sewage, proof against germs and fungus, indestructible and everlasting—like porcelain.

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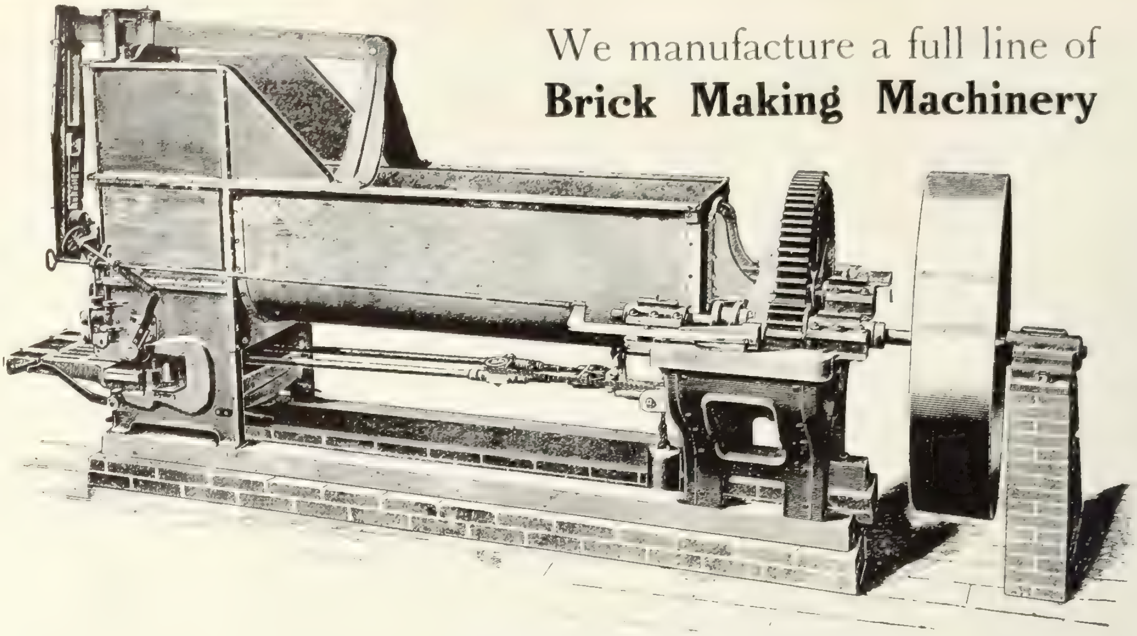

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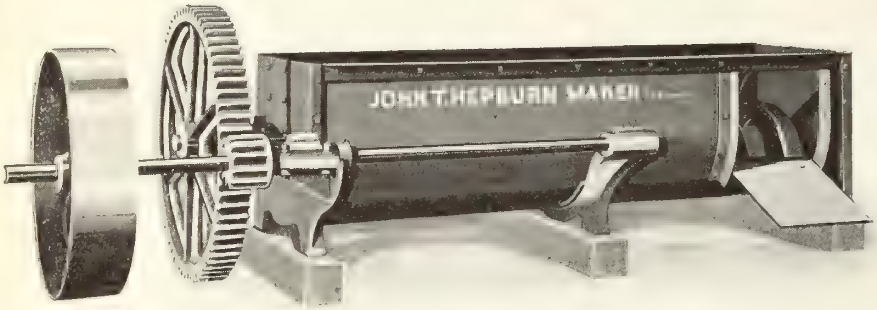
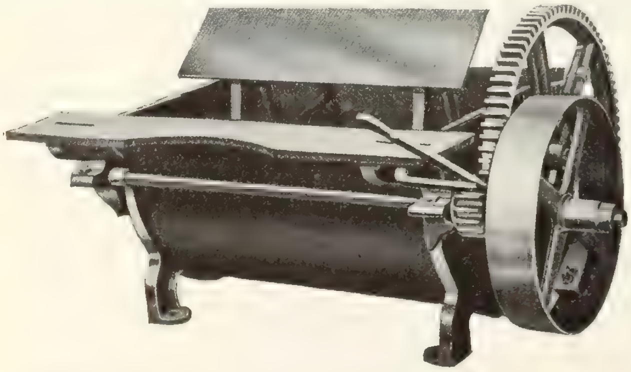
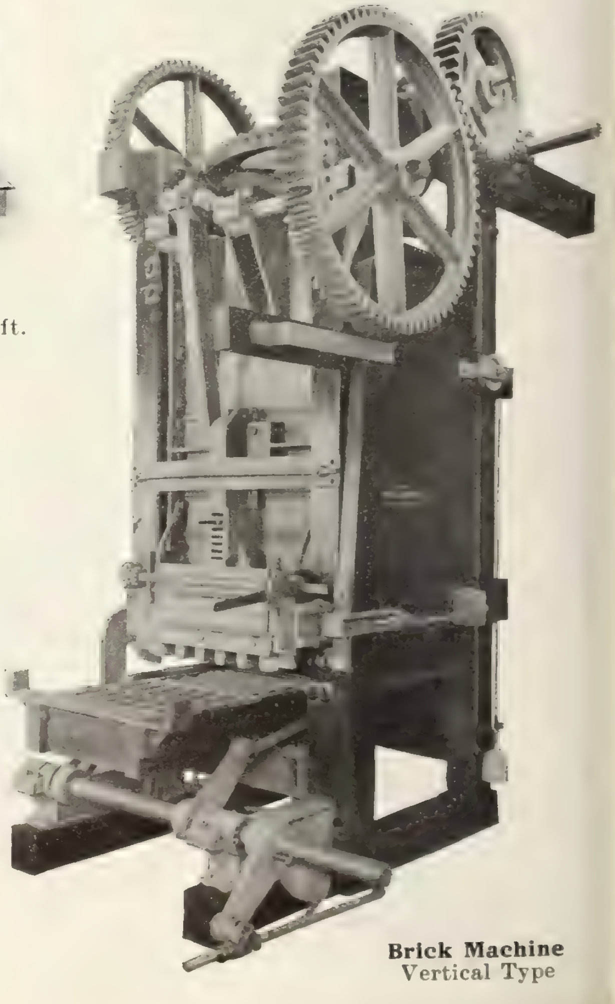


Pug Mill with steel body. End plates arranged for easy removal of shaft.



Sander with steel body. End plates arranged for removal of shaft.



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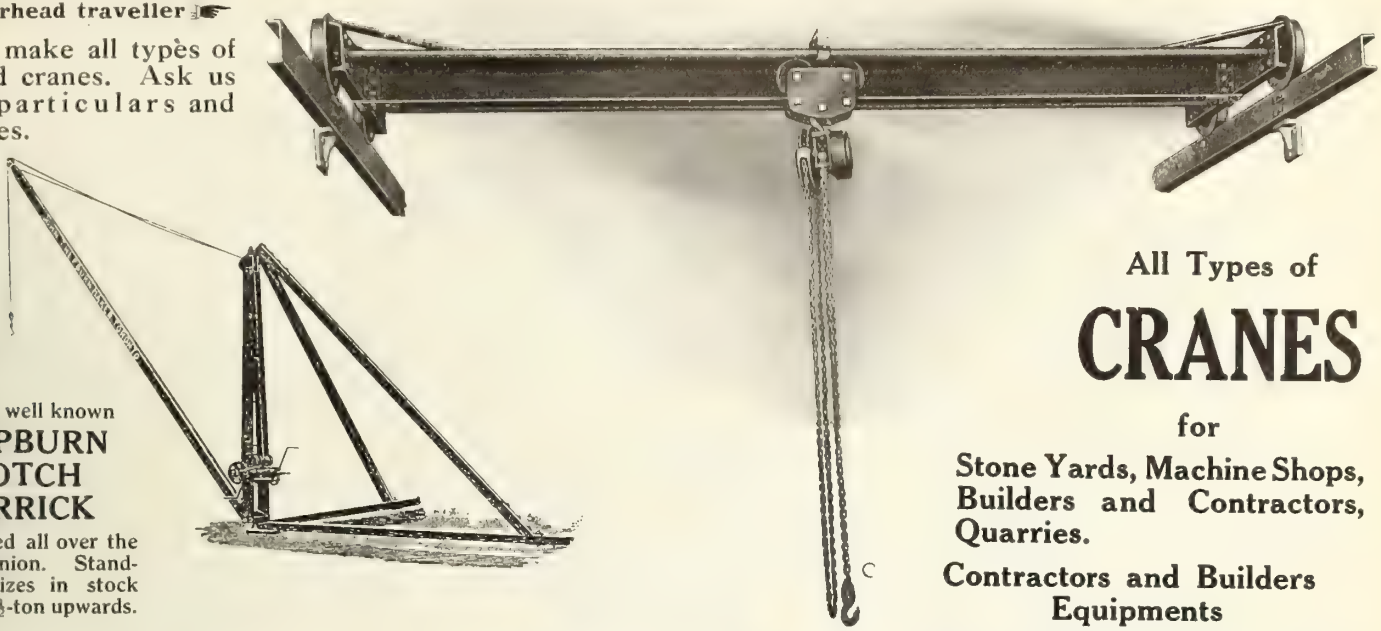

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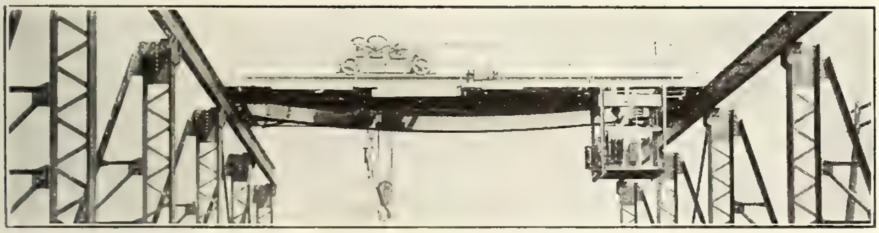

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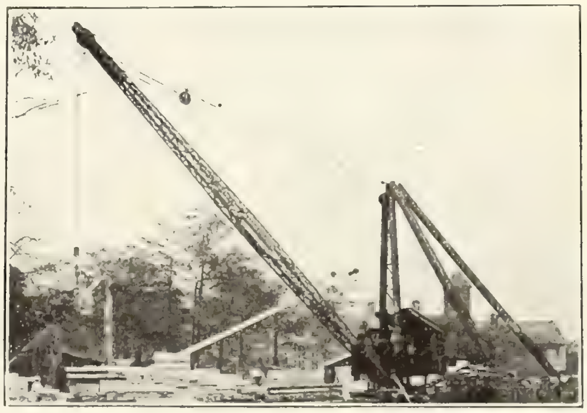

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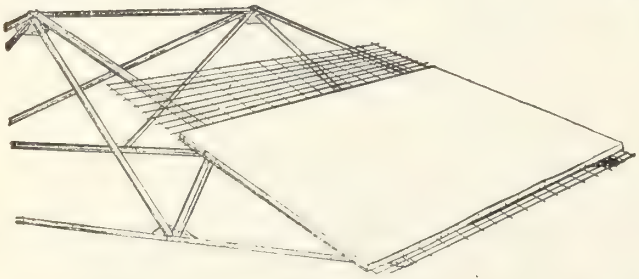

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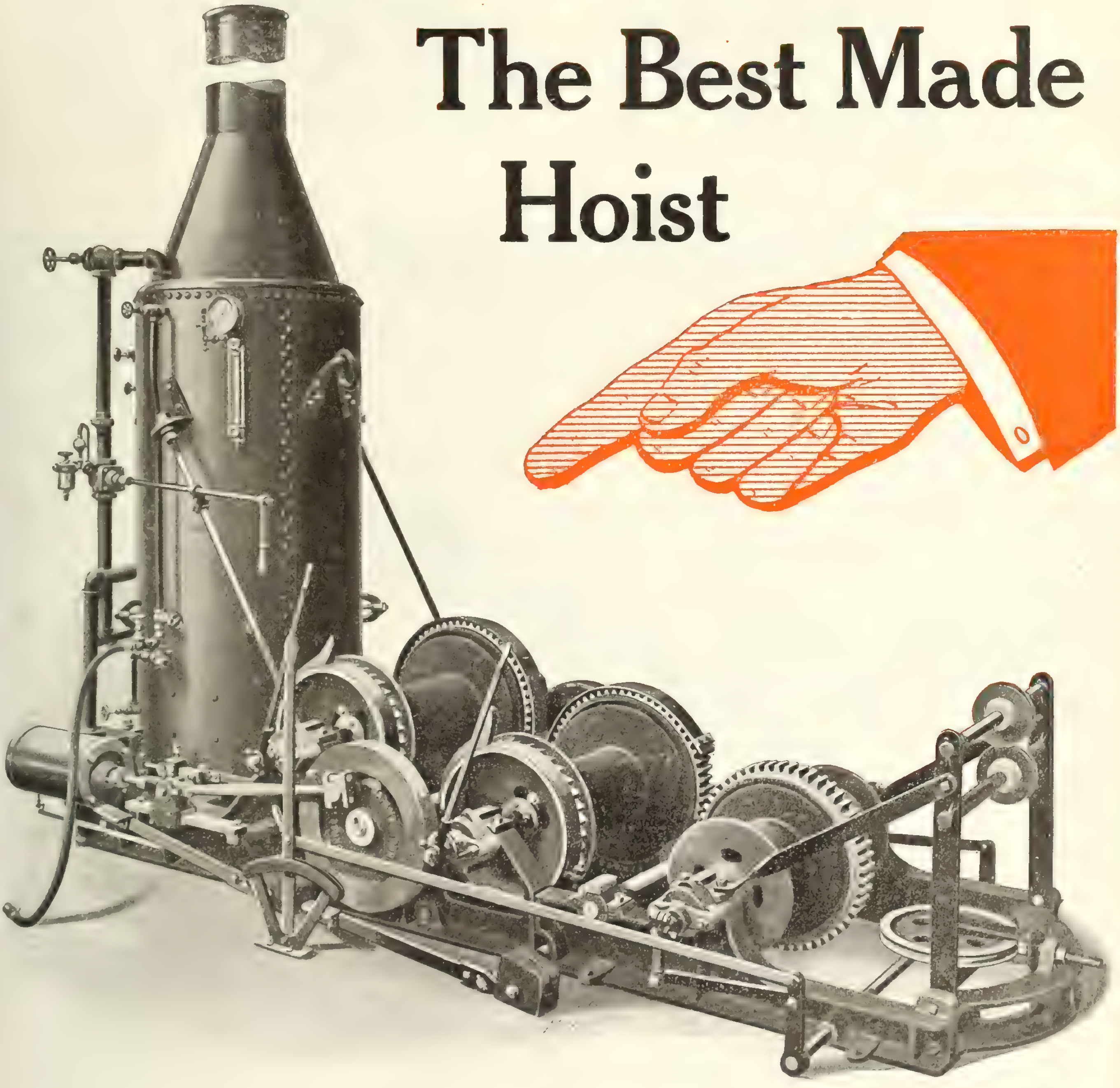

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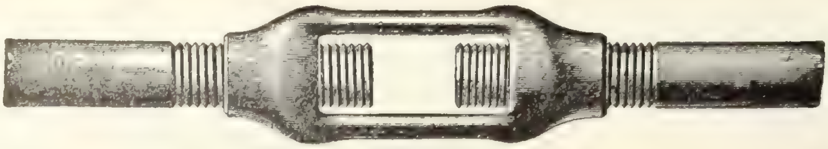

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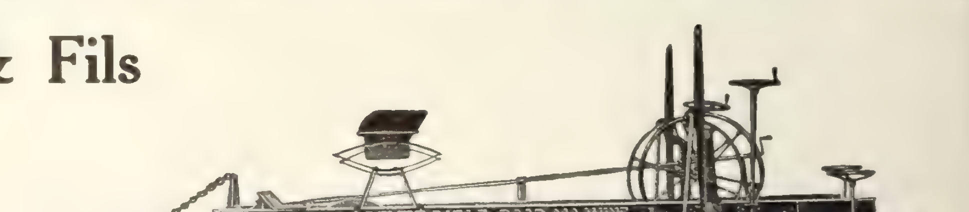
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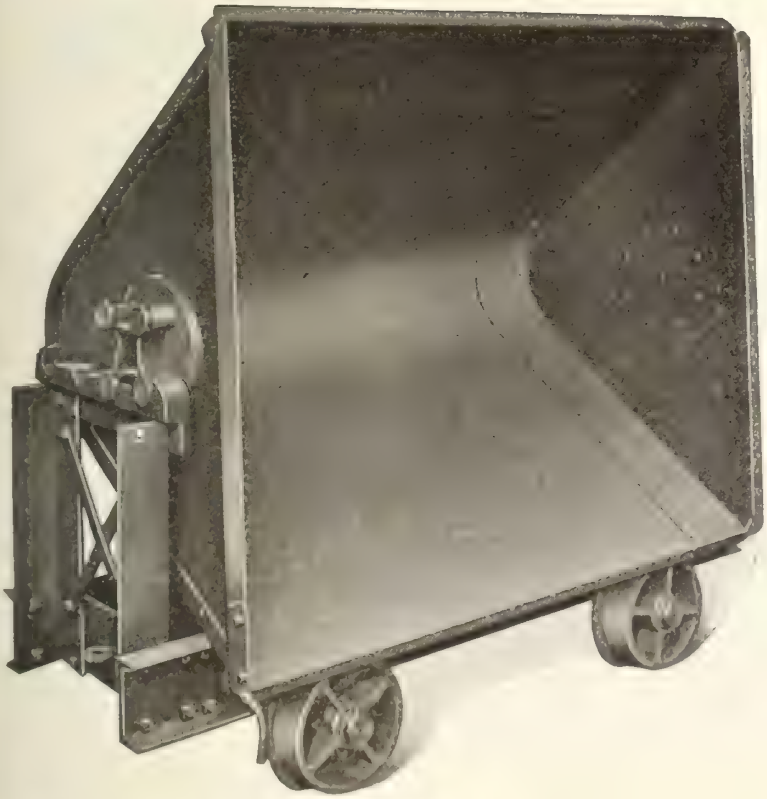

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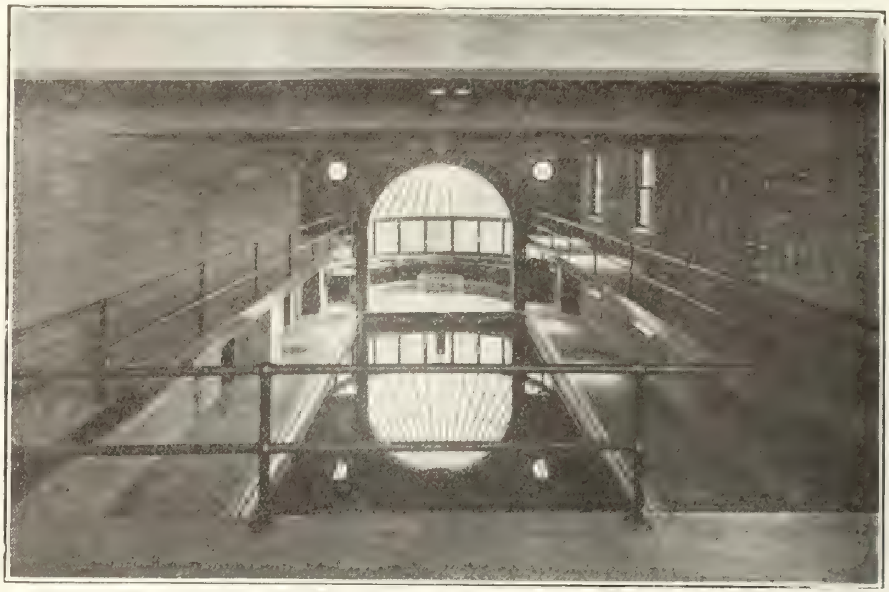

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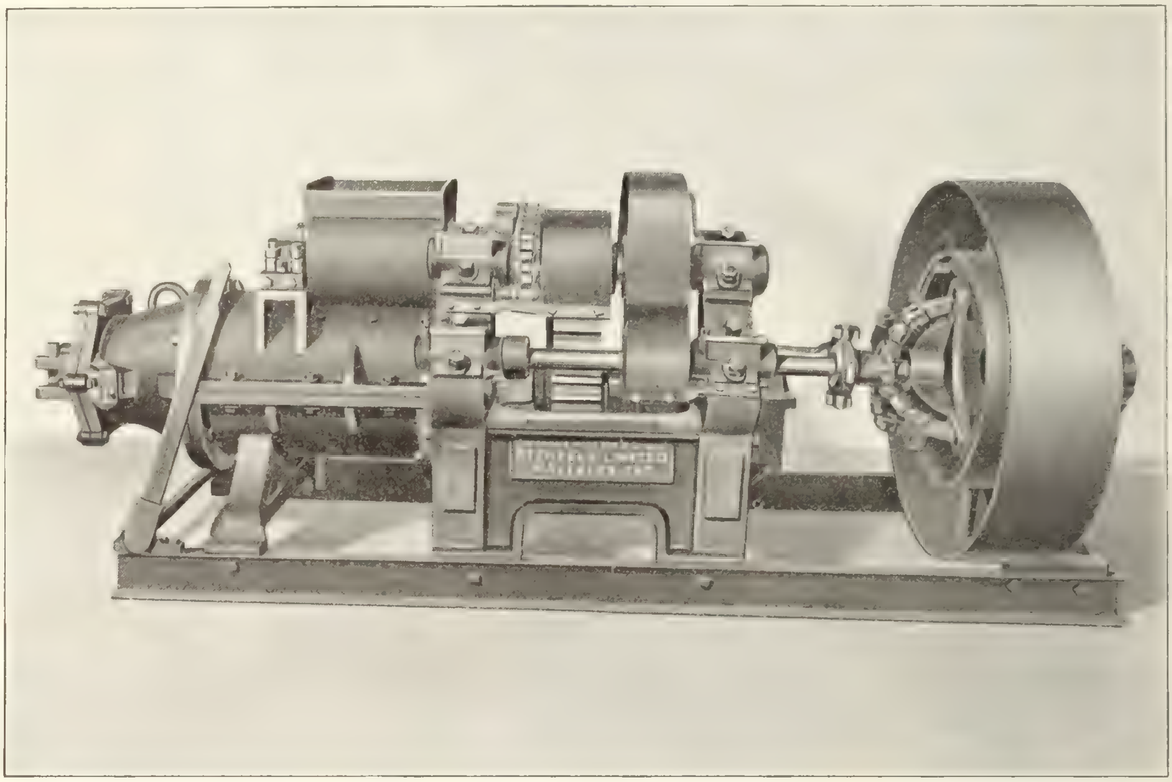

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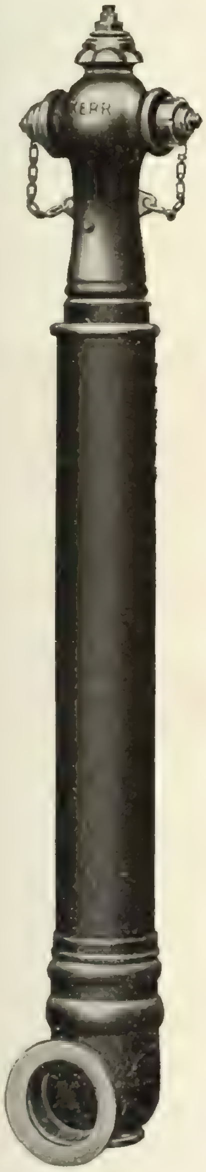

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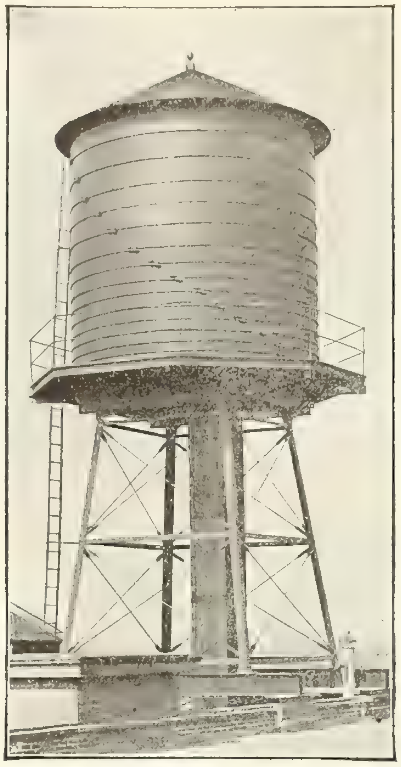

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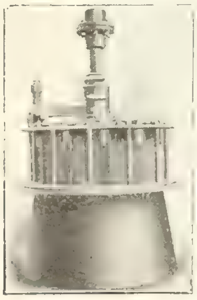

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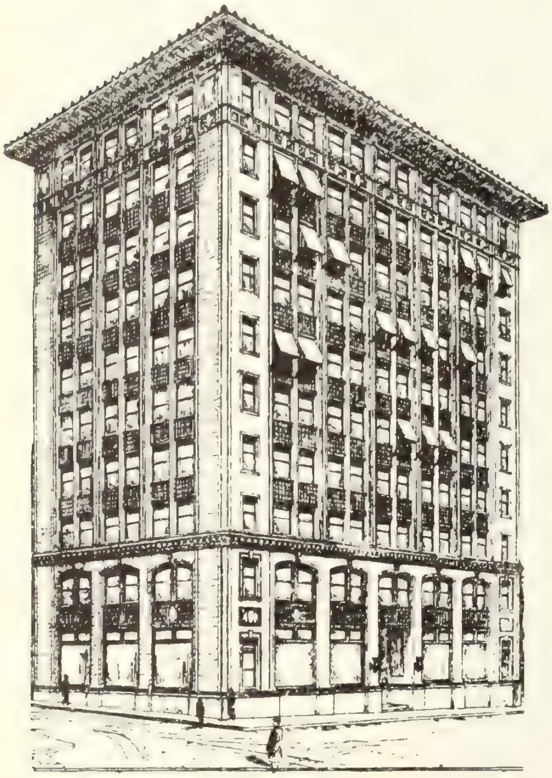

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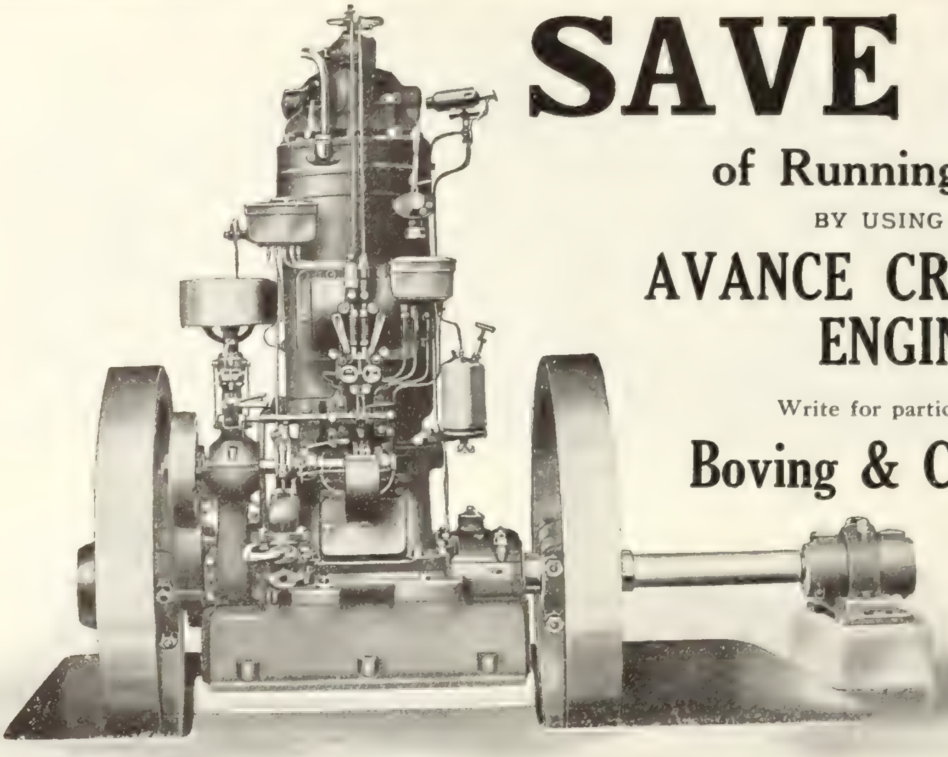

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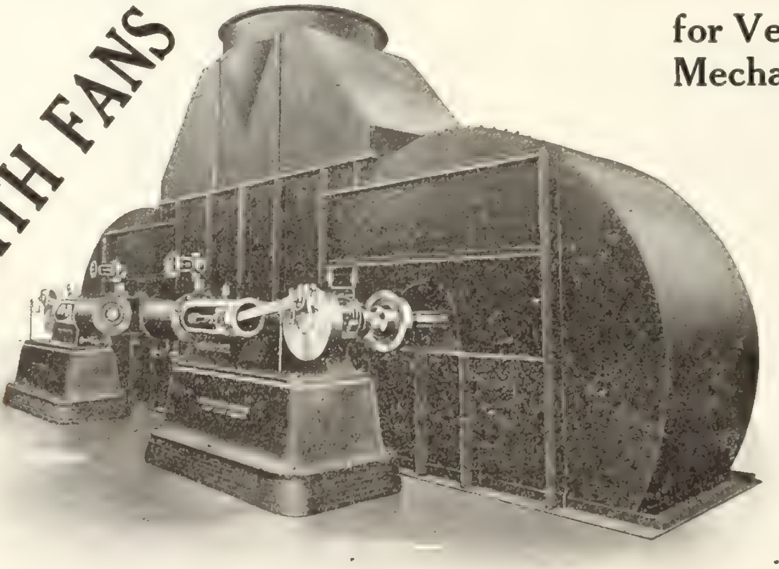

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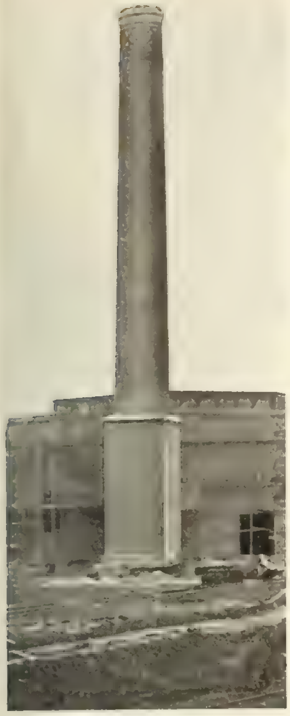

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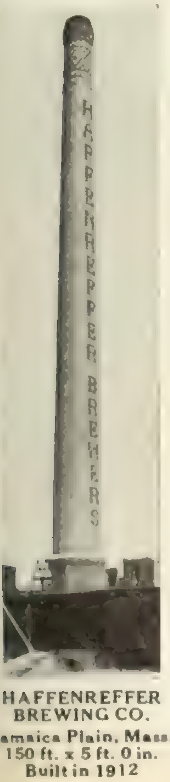

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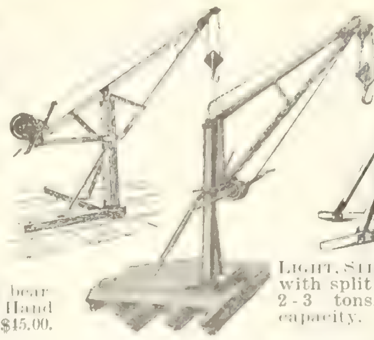

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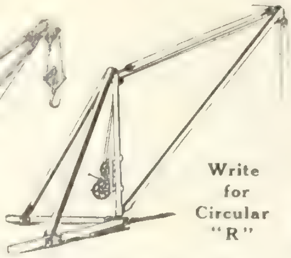

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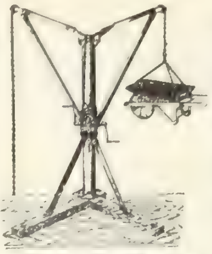

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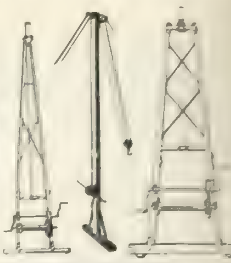

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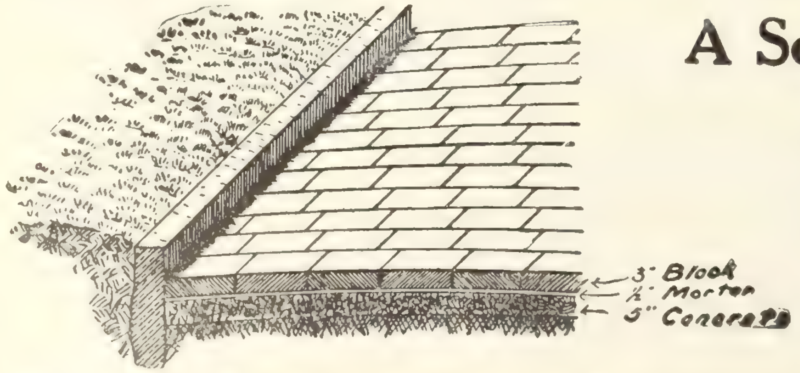

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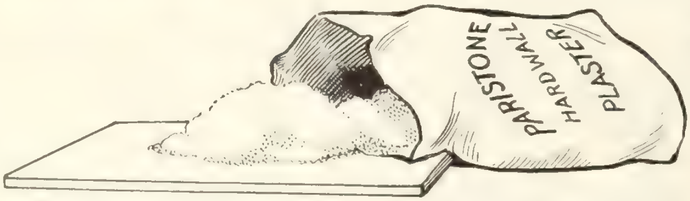

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Page 16

Vol. 27 **December 10, 1913** **No. 50**

Educational Facilities for the Clayworker

NEARLY a year ago one of our British contemporaries got hold of the idea that the Canadian Association of Clay Products Manufacturers were establishing a Chair of Ceramics at the University of Toronto. An editorial appeared in which we were complimented highly for the progressive part we were taking, and a line of comparison was even established between this country and Germany, which has long taken a pre-eminent place in the field of technical education. The mother country was represented as being put to shame by "one of her dependencies."

There are those who would immediately resent reference to Canada as a "dependency," but we must pass over this comparatively trivial point to one of the weightiest considerations which the clay-working interests have before them to-day and ask what has actually been achieved since the reports were given out which brought Canadian clay-workers into such unmerited prominence abroad. As a matter of fact nothing has been done since the Board of Governors of the University of Toronto recommended the establishment of a ceramic course, and unless further steps be taken in the near future the matter will end, for it is certain that with the deficit in the University's revenue shown in their recent statements, no funds will be appropriated for new work.

The last few years have been a period of unexampled prosperity for all identified with constructional work in Canada and it may be asserted without fear of contradiction that the clay-working industries have received rather more than a proportionate share of the harvest. If there has been such a strong desire to improve the status of the industry by placing it upon a professional basis through the medium of University courses, why have there been forthcoming no practical suggestions as to ways and means? The wherewithal of the University is not provided by any supernatural agency and the cleverest financier could not make a course of ceramics self-supporting. It is a question, then, of dollars and cents. This is generally recognised, but admitted only in whispers. The University authorities are in favor of starting a course and the laboratories already established at the University could be drawn upon for part of the equipment required. Not only that—one of the leading firms in the industry has offered to furnish whatever machinery and equipment may be required to bring the department right up-to-the-minute. But nobody has followed, and so we find ourselves in a cul-de-sac. One is forced reluctantly to the conclusion that Canadian clay-workers are generous with moral support but extremely parsimonious with financial support.

$ $ $ Must be Found

Having arrived at such a conclusion one cannot but take particular pleasure in declaring that the facilities for professional education can only be supplied at considerable cost and that the establishment of an up-to-date, well-appointed laboratory in charge of a competent lecturer and an assistant can only be effected at the cost of some sacrifice on the part of the trade.

A matter which is of equal if not of greater importance is to ascertain what provisions are being made by the city of Toronto for the clay-working interests in the new technical school. It can hardly be said that such an enquiry is timely, for it is long since overdue, other trades having concluded their arrangements and secured adequate representation.

There are excellent fields for both a University course and a technical school course. The latter is of the greater importance, perhaps, inasmuch as it provides night classes for the men who are actually doing the work and seeking higher attainment in their trade. It is through the technical school, only, that a higher standard of workmanship can be established in the near future. The benefits accruing to the trade from university facilities are further removed.

The technical school is calculated to promote, particularly, the interests of men specially adapted for practical work but lacking perhaps in executive ability. We have all met men of this type and most of us agree that it is in the best interests of clay-working that the ability of such men be used to the best possible advantage. Every clay works needs men who are strong in technical detail—men who can be relied upon to attend to both small and great matters in the operation of the plant with equal ability, care and promptitude. In all large firms there will be found, near to the top, at least one steady worker of this type—a type which is essentially the product of the technical school. The man at the top with the executive ability, or the capital, or the capacity for handling changes of policy, seldom, if ever, has anything to do with the inside of such a clay-working establishment. Nevertheless, the technical school produces the man that is the backbone of the industry.

On the one hand we enable the progressive mechanic to learn everything in connection with his practical work and on the other we provide our sons with a scientific training which will fit them to undertake all work of a theoretical nature—testing, formulation of theories, and so on.

But why dilate further upon the subject? Already too much has been written; too much has been said. What is required now is evidence of practical interest—of the kind that resolves itself into real money. When that is forthcoming it will be time to conjure up a vision of the high position which the clay-working industry in Canada may occupy some day. Meantime, we thank our friends across the water for their good intentions, but we fear we must regretfully decline the bouquets.

The Right Principle Reversed

THE contract for a mechanical filtration plant for the city of Toronto, details concerning which were published in our last issue, appears to be hedged about with specifications which are open to considerable criticism. The financial obligation placed upon the contractor is that his tender shall be accompanied by a marked cheque or cash deposit equal to 2½ per cent. of his contract price. This means no less than $25,000 on an estimate of $1,000,000. It is further stipulated that an amount equal to 80 per cent. of the work done and materials used shall be paid monthly by the city.

Continuing from the specifications:—"One year from the date on which all tests as to efficiency and capacity have been made and the general operation of the filter plant and all its accessories and appurtenances have been found satisfactory to the Commissioner, the Corporation shall, after such final estimate has been made and approved by the Council, pay the entire sum so found to be due hereunder after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained under the provision of the contract."

This means that twenty per cent. of the contract money is retained for from sixteen to eighteen months after the installation is completed—a sum of no less than $200,000 if we revert to our basis of an estimate of $1,000,000!

A bond for the proper performance of the contract is called for in a section of the specifications.

Under such stringent financial obligations tenders are practically limited to large United States companies or to wealthy contracting firms in Canada who are not manufacturers of filters. On the face of it this is a restriction of competition, as all the filters which are well known in the States are manufactured under license from one firm. British firms conduct business from Britain with agents in Canada and they would be foolish to bond themselves to such an extent, seeing that fifty per cent. of the work will be done under contractors in Canada of whom they know little or nothing.

When one million dollars' worth of standard work is done, its market value should be at least $500,000. This amount, added to the $200,000 retained by the city, would give a security of $700,000. Surely if the only object were to secure the city, this sum should be sufficient! Why, then, a limitation which practically means the exclusion of British products?

We cannot but think that these restrictions are unnecessarily severe and accordingly wrong in principle. Here we have practically closed competition with a maximum limitation. What we should have with public money is open competition with the minimum limitation. It is procedure framed on the last-named principle only which will enable us to secure the best in design and construction.

Brick at the Builders' Exchanges

BRICK has long been displayed at builders' exchanges. It was perhaps among the very first articles put on display, and it has always been a familiar product, but has it always been made enough of a live issue, asks The Clayworker.

This question was brought to mind recently in course of a discussion at a builders' exchange in which a member of the exchange said something about concrete and asked some things along the line that led to the remark that we were fighting the battle of brick and clay products. His reply to this was, "You are fighting for a cause already lost." Perhaps he was thinking of some specific instance or work in which concrete has replaced common brick, and perhaps he didn't mean just all he said or think how it would sound, but the fact that this expression could be made by a member of a builders' exchange to-day and a member not directly interested in any rival line of building material, is enough to stir to action the brick manufacturers throughout the country.

It is possible that brick manufacturers have displayed samples of their product in builders' exchanges all along and have taken too much for granted the idea that the good qualities of brick were known and understood and needed no elaboration. It is just such resting on laurels of this kind and permitting things to go along without active exploitation and keeping the subject alive that makes a lot of room for other fellows to come along and spring something new and keep it before the public so continuously that they will forget about other things and go so far as to imagine that brick belongs to the class of has-beens.

In view of all this, it appears to us that it behoves the brick manufacturers in all the cities where there are builders' exchanges to get busy and have a readjustment of matters and a thorough stirring up. Develop some new ideas as to display and see that brick and other clay products are so conspicuously displayed that they will attract attention, and then, above all, see to it that the subject is brought to the minds of the members and visitors in such a manner that there will be no chance for the idea to gain ground that brick is a lost cause in competition with concrete or anything else. We know it is not, but that doesn't keep it from hurting when an expression of this kind is heard on the outside, and it should hurt the average brick manufacturer enough to arouse his energy and stir things up in connection with builders' exchanges. The more the subject of building material is stirred up and agitated the more it will make favor for brick, because the more thoroughly those things are aired and sifted down by analytical study the more certain it is that brick and other burned clay praducts will stand out conspicuously in home building as well as the erection of big fireproof structures.

A German inventor has taken out an English patent for an enamel substance which is claimed not to require heat to produce the glaze on pottery ware. The ware or articles are submerged in the mixture, and after being in contact with it for a certain time are taken out to dry, and the glazing is done. The substance is made by thoroughly mixing three parts of glowing magnesium oxide of a specific gravity of 3.0 with four parts of saturated cold watery solution of magnesium chloride. To this mixture is added a solution of shelac or sandrac gum in alcohol, in the proportion of 25 to 100.

Production of Clay Products in Canada[*]

Comparative Statistics Reveal Gratifying Progress and Many New Records—Largely Increased Imports of Brick and Tile

By John McLeish, Chief of the Division of Mineral Resources and Statistics, Ottawa

THE utilization of mineral and material products of the earth, in our present scheme of existence, may be said to be of as great importance almost as the production of food or the actual means of sustaining life itself. Modern civilization tends towards a most complicated interrelationship of all human activities and under these conditions the great harvests of life's necessities could not be secured or kept without the aid of the products of the mine. Whether the price of land goes up, or whether it goes down, wheat must be grown, buildings constructed and means of transportation provided.

Amongst materials of construction, clay is at once the most abundant and one of the most extensively used. Canada is at present absorbing annually from outside sources, a population equivalent to about five per cent. of her population over and above the natural increase. This growth, or development which seems destined to continue as long as we have suitable agricultural lands to settle, must of necessity be accompanied by constructive activity of all kinds—railways, highways, public works, commercial and private building, etc., greatly in excess of the normal. Such a period of intensive development has now been in progress for some years and a rapid increase in the production of structural materials of all kinds is shown in the annual records collected and published by the Department of Mines at Ottawa. Since this record is collected only once a year and the period of time covered is the calendar year, it will be some months yet before a complete record for the year 1913 is available, but from what is known of the activity of the industry during the year, and if the imports during eight months may be taken as a criterion of consumption, it seems safe to assume that the clay industry during 1913 has made similar records of progress to those which it achieved in 1912. During eight months of 1913, the imports of clay products exceeded in value by 13 per cent. the imports during the corresponding period of the previous year.

Although this review is intended to deal primarily with clay products, it may be remarked in passing that the total value of the production during 1912 of materials of construction, such as cement, clay, lime, building and other stone, etc., was $28,794,869, an increase of nearly 27 per cent. over the production in 1911; which was valued at $22,709,612; and comparing with a production valued at $19,627,592 in 1910; $16,533,349 in 1909, and $11,339,955 in 1908. These statistics should be used in a comparative rather than in an absolute sense because of the probable incompleteness of the record of production of sand and gravel, and of stone.

Of the total value of these materials of construction produced in 1912, about 36 per cent. consisted of clay products, valued at $10,575,869. The production in 1911 was valued at $8,359,933, thus showing an increase in 1912 of $2,215,936 or over 26.5 per cent. During the past few years many new plants have been erected both in eastern and western Canada. For the year 1912 about 459 active firms reported, as against 419 firms active in 1911, and 438 firms in 1910. The average number of men employed in 1912 was 10,415, as compared with 9,131 in 1911 and 8,656 in 1910. The total wages paid in 1912 were $4,488,957, as against $3,524,058 in 1911.

Of the several provinces Ontario is by far the largest producer of clay products, being credited in 1912 with 46 per cent. of the total value of the output, as compared with 47 per cent. in 1911. Quebec contributed 16 per cent. of the total output in both years. Alberta about 12.5 per cent.; Manitoba 10 per cent., and British Columbia 8 per cent. in 1911, and 9.4 per cent. in 1912.

Of the total value of the production in 1912, building and paving brick, including fireproofing, contributed $9,163,666, or about 86 2/3 per cent.; sewer pipe and tile production were valued at $1,242,503, or 11.7 per cent. of the total. The total value of the production of pottery was reported as $426,589, of which $43,955 is estimated as attributable to Canadian clays, the balance to imported clays; the value of the production of fireclay and firebrick was $125,585. Compared with the previous year, the production of building, paving and fireproofing brick, shows an increase of about 30 per cent., while the aggregate production of sewer pipe and drain tile, shows a slight falling off.

Exports and Imports

The only export of clay products recorded is that of building brick, of which the exports in 1912 were 694,000, valued at $8,493, and manufactures of clay valued at $256. In 1911 the exports were: building brick 394,000 valued at $3,997, and manufactures of clay valued at $2,071.

The imports of clay products, and of clay, reached a total value during the calendar year 1912 of $6,592,540, equivalent to about 62 per cent. of the domestic production. The total imports in 1911 were valued at $5,156,544, showing an increase in 1912 of $1,435,996, or nearly 28 per cent., as against an increase in 1911 over 1910 of 19 per cent. In both years the imports have increased at a higher rate than the domestic production. Clay imports are classified by the Department of Customs under three main subdivisions, including: brick and tile, earthenware and chinaware, and clays. The imports of clays in 1912 were valued at $288,394 and included chiefly china-clay and fireclay, with a small quantity of pipeclay and other clays not classified. The value of china-clay imports was $127,402, and of fireclay $140,500. In 1911 the total value of the imports of clays was $270,247, and included china-clay valued at $125,768 and fireclay valued at $125,199. The imports of these clays have varied considerably from year to year, and do not show the same general increase as do the imports of manufactured clays. The imports classified under brick and tile, were valued in 1912 at $3,209,190, of which about 28 per cent. was firebrick, other important items being: building brick, sewerpipe, and paving brick. There was also an importation under this class of manufactures of clay not specially designated, valued at $818,467. The value of the imports of brick and tile in 1911 was $2,369,761, of which about 34 per cent. was firebrick. The imports during 1911 of manufactures of clay not specially designated, were valued at $523,998. The imports of these unclassified brick and tile have increased steadily year by year, the value of such imports in 1905 having been only $20,804. The increase in the imports of brick and tile in 1912, as compared with 1911 was a little over 35 per cent. The imports of earthenware and chinaware, of which the most important class is tableware, were valued in 1912 at $3,094,956, as against $2,516,536 in 1911, or an increase of about 23 per cent.

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[*] Specially contributed by permission of the Director of Mines.

Imported clay products are derived chiefly from Great Britain and the United States, although considerable quantities of earthenware, china, and porcelain ware, white granite or ironstoneware, etc., are brought from Germany, France, Austria-Hungary and Japan. Of the brick and tile imported 82 per cent. was from the United States and 17.9 per cent. from Great Britain; and only $2,045 worth from other countries. Of the earthenware and chinaware, 60 per cent. was imported from Great Britain; 16 per cent. from the United States; 12 per cent. from Germany; 5 per cent. from France, and considerable values also from Japan, Austria-Hungary, and other countries. The crude clays were imported principally from Great Britain and the United States.

In thirteen years Canada has imported clay products to the value of $35,396,706. The increase in imports has been most pronounced in the case of brick and tile, the imports of which in 1900 amounted to $145,914, as compared with $2,462,181 in 1912. The imports of earthenware and chinaware have almost doubled in the same time.

Ratio of Production to Consumption

A comparison of statistics of imports with those of production is instructive. It will be observed that the total value of the imports in 1912 was $6,592,540 (not including certain items probably covering clay products) and after deducting a small export, a total approximate consumption of clay products valued at $17,160,660 is shown, of which about 62 per cent. was of domestic production.

In 1911, the approximate consumption was valued at $13,516,477, of which about 62 per cent. was of domestic production. In 1909 the approximate consumption was valued at $9,172,995, of which about 70 per cent. was of domestic production.

While the imports of building brick continues to increase the total value is still small compared with the home production. In the case of paving brick, however, the imports are about double, and of firebrick nearly eight times the Canadian output. The imports of sewer pipe have also increased much more rapidly than the production during the past year.

Clay Building Brick

In 1912 the total sales were 894,371,954, valued at $8,620,229, made up of 769,191,532 common, valued at $7,010,375, or an average value per thousand of $9.11; and 125,180,422 pressed brick, valued at $1,609,854, or an average value per thousand of $12.86. In addition to the common and pressed brick there was a production of ornamental brick of 371,356, valued at $8,595, and a production of fireproofing brick and architectural terra-cotta, valued at $448,853.

There were 459 active firms reporting in 1912, as compared with 419 firms in 1911, and 397 firms in 1910.

The exports have never been large, averaging for a number of years past about $6,000 per annum. The exports fell off somewhat in 1911 to a value of $3,977, but increased again in 1912 to a value of $8,493. The annual imports for a number of years previous to 1903 averaged only about $20,000 in value, during the past nine years, however, the imports have rapidly increased from $100,000 to nearly $800,000 per annum. During the calendar year 1912, the imports were 81,425,000 brick, valued at $763,470, of which 3,071,000, valued at $32,731, or an average of $10.66 per thousand, were imported from Great Britain and 78,350,000, valued at $730,739, or an average of $9.33 per thousand, from the United States. The imports during the calendar year 1911 were 51,102,000 brick, valued at $475,865, of which 6,404,000, valued at $72,675, or an average of $11.35 per thousand, were imported from Great Britain, and 44,698,000, valued at $403,190, or an average of $9.02 per thousand, from the United States.

Nova Scotia and New Brunswick.—There was a slight falling off in the production of brick in Nova Scotia in 1912 and a small increase in the production in New Brunswick. Comparatively little pressed brick is made. The total value of the output in Nova Scotia was $130,108 and the chief sources of production, Annapolis Royal, Middleton, Pugwash, Mira Gut, River Denys and New Glasgow. A feature of special interest during 1912 was the consolidation of the clay working plants at Annapolis Royal, Bridgetown, Middleport, Pugwash and Elmsdale, under the name of the Nova Scotia Clay Works, Limited.

The total value of the production in New Brunswick was $53,350 and the principal sources of production, Fredericton, St. John, Little River, Chatham and St. Stephen.

Quebec.—The total production of brick in Quebec in 1912 is reported by 74 operating firms as 173,336,557, valued at $1,446,880, comprising 161,836,557 common brick, valued at $1,308,380, or $8.08 per thousand, and 11,500,000 pressed brick valued at $138,500 or $12.04 per thousand.

The production by 60 active firms in 1911 was reported as 122,041,580 brick, valued at $1,033,270.

While brick-making is carried on at many places in the province, the principal plants are located at La Prairie, Sherbrooke and St. Jean des Chaillons.

Ontario.—Over 44 per cent. of the brick production in Canada in 1912 was made in Ontario, the total sales as reported by 271 firms being 423,670,184, valued at $3,807,195, and including 350,461,874 common brick valued at $3,045,840, or an average of $8,69 per thousand, and 73,208,310 pressed brick, valued at $761,355, or an average of $10.40 per thousand. The total sales in 1911 as reported by 262 operating firms were 369,004,371 valued at $3,028,046, and comprised 318,670,621 common brick, valued at $2,513,965, or an average of $7.89 per thousand, and 50,333,750 pressed brick, valued at $514,081, or an average of $10.21 per thousand.

The city of Toronto and vicinity, including the counties of York and Halton, is the principal brick making section and in 1912 produced about 52 per cent. of the Ontario production, or about 23 per cent. of the total Canadian production of brick. The district next in importance, is the county of Wentworth, comprising the city of Hamilton and vicinity, producing nearly 11 per cent. of the Ontario production. The Ottawa district, including the counties of Russell and Carleton, produced over 7 per cent. The greater part of the pressed brick, reported as such, was made in the Toronto and Hamilton districts.

In addition to the ordinary clay building brick, there was produced in this province in 1912 ornamental brick valued at $7,168, and fireproofing and terra cotta valued at $135,087. In 1911 the production of ornamental brick was valued at $7,441, and of fireproofing and terra cotta $51,080.

Manitoba.—The production of clay building brick in the province in 1912 as reported by 21 firms, was 87,178,937, valued at $1,012,801, comprising 83,681,237 common brick, valued at $957,854, or an average of $11.47 per thousand, and 3,497,700 pressed brick, valued at $52,947, or $15.13 per thousand. The production as reported by 18 firms in 1911 was 81,400,000, valued at $826,928, and included 79,600,000 common brick, valued at $805,178, or $10.11 per thousand, and 1,800,000 pressed brick valued at $21,750, or $12.08 per thousand.

The principal brick-making plants are located at Winnipeg, St. Boniface, Morris, Lac du Bonnet, Portage La Prairie, Sidney, Brandon, Gilbert Plains, Virden, Balmoral, Lavenham, Neepawa, and Whitemouth.

Saskatchewan.—Returns from 14 operating firms show a production in 1912 of 30,538,771 brick, valued at $332,943, which includes 25,338,771 common brick, valued at $246,443, or an average of $9.73 per thousand, and 5,200,000 pressed brick valued at $86,500, or an average of $16.63 per thousand. The total production in 1911 by 13 firms was 21,071,660 brick valued at $224,758.

The principal clay plants are located at Estevan, Prince Albert, Saskatoon, Weyburn, Rosthern, Verigin, Arcola and Broadview.

Alberta.—The production of building brick has been increasing very rapidly and in 1912 the production in this province was surpassed only by Ontario and Quebec. During the past year the sales as reported by 33 active firms were 93,759,980 brick, valued at $1,105,912, as compared with sales by 28 firms in 1911 of 71,772,930 brick valued at $779,001. The 1912 output comprised 70,074,568 common brick, valued at $755,986, or an average of $10.69 per thousand, and 23,685,412 pressed brick, valued at $349,926, or an average of $14.77 per thousand. In addition to building brick there was a production in this province during 1912 of fireproofing valued at $248,712.

The principal centres of production are Edmonton, Cochrane, Calgary, Medicine Hat, Redcliff, Lethbridge, Red Deer, Brickburn, Innisfail and Vermilion.

British Columbia.—The brick-making industry has also grown rapidly in British Columbia, the increase of production of 1912 over 1911 being 64 per cent. During 1912 the total sales were 61,284,565, valued at $731,040, and included 53,345,565 common brick, valued at $512,514, or an average of $9.61 per thousand, and 7,939,000 pressed brick, valued at $218,526, or an average of $27.53 per thousand. In 1911 the total sales were 39,680,515 brick, valued at $443,829. There were 28 active firms engaged in brick-making in 1912, as compared with 19 in 1911.

The principal centres of manufacture are Vancouver, New Westminster, Clayburn, Cloverdale, Bazan Bay, Pender Island, Port Haney and vicinity, Anvil Island, Victoria and Sydney.

Paving Brick

The total production of paving brick and paving blocks in Canada in 1912 was reported as 4,579,500, valued at $85,989, or an average value per thousand of $18.78, as compared with a production of 5,220,400, valued at $79,444, or an average value of $15.22 per thousand in 1911.

This paving brick is made chiefly at West Toronto, Ontario, from shale obtained from the banks of the Humber river, although during 1912 there was also a small production reported at Pender Island, near Vancouver, B.C.

The annual production has for a number of years varied from three million to over five million per season, and the output finds a market chiefly in Toronto.

The imports of paving brick during the past four years have considerably exceeded the domestic production. During the calendar year 1912 the imports were 11,793,000, valued at $160,663, or an average value of $13.62 per thousand, and included 6,709,000, valued at $95,610, or $14.25 per thousand from the United States; 5,044,000 valued at $64,375 or $12.76 per thousand from Great Britain; and 40,000 valued at $678 or $16.95 per thousand from other countries.

Fireclay and Fireclay Products

There are a number of clays from different localities in Canada that have been used in the manufacture of refractory brick, or firebrick and for furnace linings, etc., which have been usually termed "fireclays." These include clays found with the coal measures at Westville, Nova Scotia, and at Comox, Vancouver Island, also clays found south of Moose Jaw, Sask., and at Clayburn, near the city of Vancouver, B.C. Stove linings and other refractory clay products are made at several places in Ontario and Quebec from imported clays.

The total value of the sales of fireclay, firebrick, and fireclay products in 1912, was $125,585, as compared with a valuation of $89,130 in 1911, and $50,215, in 1910. There was in addition in 1912 a production of fireclay products valued at $25,000 reported as being made from imported clays.

The production in 1912 included fireclay or refractory clay sold as such to the extent of 6,307 tons, valued at $24,343; firebrick 3,429,594 valued at $67,192, or an average of $19.59 per thousand; and other fireclay products valued at $34,050.

The imports of firebrick during the calendar year 1912 were valued at $953,621, of which $860,587 worth was imported from the United States; $91,236 from Great Britain, and $1,798 from other countries. Fireclay was imported for the calendar year 1912 to the value of $140,500, as compared with a value of $125,199 in 1911, and $124,293 in 1910.

Sewerpipe and Drain Tile

The total value of the sales of sewerpipe in 1912 was $884,641, as compared with a value of $812,716 in 1911, and a value of $774,910 in 1910. About 54 per cent. of the production in 1912 was made in Ontario.

The imports of drain pipe and sewerpipe during 1912 were valued at $507,024, of which $431,600 was imported from the United States; $75,394 from Great Britain, and $30 from other countries.

The total value of sales of drain pipe in Canada in 1912, as reported to this Branch was $357,862, as compared with $339,812 in 1911, and $370,008 in 1910. The greater part of this production is in the province of Ontario, the sales in this province in 1912, as reported to this Branch were valued at $308,050, as against a value of $300,029 in 1911, and $334,402 in 1910.

The Ontario Bureau of Mines reports the total

PRODUCTION OF CLAY PRODUCTS BY PROVINCES, 1912.

Province	No. of active firms reporting	No. of men employed	Wages	Common Brick No. manufactured	No. sold	Value of Sales	Per M	Pressed Brick No. Manufactured	No. Sold	Value of Sales	Per M
			$			$	$ c.			$	$ c.
Nova Scotia ...	11	316	98,939	20,095,202	18,722,960	128,508	6.86	220,000	100,000	1,600	16.00
New Brunswick	7	148	45,536	6,179,000	5,730,000	52,850	9.22	50,000	50,000	500	10.00
Quebec	77	1,917	615,221	181,219,323	161,836,557	1,308,380	8.08	10,386,454	11,500,000	138,500	12.04
Ontario	271	4,696	2,060,542	356,961,931	350,461,874	3,045,840	8.69	75,231,791	73,208,310	761,355	10.40
Manitoba	21	1,088	465,926	83,559,437	83,681,237	959,854	11.47	3,450,000	3,497,700	52,947	15.13
Saskatchewan	11	383	152,651	24,603,771	25,338,771	246,443	9.73	5,950,000	5,200,000	86,500	16.63
Alberta	33	1,053	557,223	73,394,693	70,071,568	755,986	10.69	25,798,410	23,685,112	349,926	14.77
British Columbia	28	814	492,916	56,569,470	53,345,565	512,514	9.61	8,210,800	7,939,000	218,526	27.53
Totals.	459	10,415	4,488,957	802,582,827	769,191,532	7,010,375	9.11	129,297,455	125,180,422	1,609,854	12.86

Province	Paving Brick No. Sold	Value	Ornamental No. Sold	Value	Firebrick and fire-clay shapes, Value	Fireproofing and terra cotta, etc., Value	Pottery, Value	Sewerpipe, Value	Tiles drain, Value		Total value Clay products
		$		$	$	$	$		$	$	$
Nova Scotia	....	.	.	.....	15,375	1,270	..	115,000	10,300	...	272,053
New Brunswick			.	.....	....	...	...	.	1,560		54,910
Quebec				....	25,000	42,530	500	165,000	390	160	1,680,460
Ontario	4,554,500	85,589	352,816	7,168	......	135,087	43,455	478,156	308,050	..	4,864,700
Manitoba	....		...	.....	......	.....	..		5,250	.	1,018,051
Saskatchewan	.	.		....	.....				.	..	332,943
Alberta	...	..	10,000	1,000	......	248,712	...	.....	560	..	1,356,184
British Columbia .	25,000	400	8,540	427	85,210	21,254	.	126,485	31,752		996,568
Totals ...	4,579,500	85,989	371,356	8,595	†125,585	448,853	43,955	884,641	357,862	160	10,575,869

*There was also a production of 383,154 from imported clays

†Also a production of $25,000 from imported clays.

PRODUCTION OF CLAY PRODUCTS BY PROVINCES, 1907-1912.

Province	1907	1908	1909	1910	1911	1912
	$	$	$	$	$	$
Nova Scotia	125,560	117,833	188,185	204,782	274,249	272,050
New Brunswick	57,377	75,513	65,570	56,475	38,000	54,910
Quebec	1,214,108	893,717	1,153,832	1,442,842	1,341,467	1,680,300
Ontario	3,123,372	2,476,152	3,425,841	3,667,810	3,916,575	4,864,700
Manitoba	466,432	265,091	559,008	781,605	834,428	1,018,051
Saskatchewan	125,459	87,566	145,516	160,850	226,958	332,943
Alberta	353,672	240,384	442,486	753,232	1,052,751	1,356,184
British Columbia	306,137	344,446	470,402	562,360	675,505	996,568
	5,772,117	4,500,702	6,450,840	7,629,956	8,359,933	10,575,709

IMPORTS OF CLAY PRODUCTS, 1907 TO 1913.

Imports	9 months ending March, 1907	12 months ending March, 1908	12 months ending March, 1909	Calendar year 1909	Calender year 1910	Calendar year 1911	Calendar year 1912	8 months ending August, 1913
Brick and tiles	$	$	$	$	$	$	$	$
Bath brick	1,076	1,834	1,432	1,495	2,290	2,623	1,927	1,635
Building brick	88,144	139,105	108,773	195,360	274,482	475,865	763,470	400,374
Paving brick	23,256	61,346	101,187	139,366	124,994	164,292	160,663	110,340
Firebrick, of a class or kind not made in Canada.	*506,801	639,347	350,457	485,994	811,927	814,414	953,621	698,636
Drain tile, not glazed	12,106	2,080	2,394	2,785	4,485	5,640	4,018	8,021
Drain pipe, sewerpipe, and earthenware fittings therefor, chimney linings or vents, chimney tops and inverted blocks, glazed or unglazed.	93,458	125,747	106,399	170,280	175,599	382,929	507,024	338,254
Manufactures of clay, N.O.P.	45,845	110,097	141,391	254,170	361,996	523,998	818,467	520,829
Total	770,686	1,079,556	815,033	1,249,450	1,755,773	2,369,761	3,209,190	2,078,089
Earthenware and chinaware:—								
Brown or colored earthenware and stoneware, and Rockingham ware	9,625	22,847	28,273	36,673	53,413	52,100	62.161	44,391
C. C. or cream colored ware, decorated, printed or sponged, and all earthenware, N.O.P.	154,879	239,513	197,623	219,936	202,475	184,291	291,804	172.979
Demijohns, churns, or crocks	9,342	17,836	10,571	8,888	6,607	4,933	18,404	21,662
Tableware of china, porcelain, white granite or ironstone ware	902,798	1,555,517	1,202,537	1,212,365	1,545,538	1,718,582	2,068,362	1,507,610
China and porcelain ware, N.O.P.	134,675	109,446	87,798	87,467	95,509	62,025	71,751	30,731
Tiles or blocks of earthenware or stone prepared for mosaic flooring	62,547	45,836	43,299	56,974	90,524	123,200	160,082	119,624
Earthenware tiles, N.O.P.	67,027	116,480	79,854	81,393	125,772	154,351	239,391	194,332
Manufacture of earthenware, N.O.P	81,987	83,309	66,932	78,063	163,278	217,051	183,001	174,676
Total	1,422,880	2,190,784	1,716,887	1,781,759	2,283,116	2,516,536	3,094,956	2,266,005
Clays:—								
China-clay, ground or unground	78,772	97,236	90,922	100,066	142,125	125.768	127,402	113,409
Fireclay, ground or unground	85,044	155,873	77,146	86,161	124,293	125,199	140,500	92,352
Pipeclay, ground or unground	307	319	887	310	114	1,786	234	340
Clays, all other, N.O.P.	14,117	14,292	21,280	29,793	25,976	17.494	20.258	16,848
Total	178,240	267,720	190,235	216,330	292,508	270,247	288,394	222,949
Grand total	2,371,806	3,538,060	2,722,155	3,247,539	4,331,397	5,156,544	6,592,540	4,567,043
Baths, bath-tubs, basins, closets, lavatories, urinals, sinks and laundry tubs of any material	62,547	234,505	157,881	211,837	262,667	285,847	382,920	326,439
Chalk, china or cornwall stone, cliff stone and feldspar, fluorspar, magnesite, ground or unground	7,376	72,467	81,675	96,747	121,959	147,640	167,990	101,974

*Includes stove linings, N.E.S.

number of drain tile made in that province during 1912 as 16,463,000, valued at $279,579, or an average of $16.98 per thousand, as compared with 21,630,000, valued at $349,545, or an average of $16.16 per thousand in 1911.

The imports of unglazed tile are comparatively small, the value during the calendar year 1912 being $4,018 only, as compared with $5,640 in 1911, and $4,485 in 1910.

Pottery and Earthenware

The pottery made from Canadian clays has been, hitherto, chiefly of the common grades, such as flowerpots, jardinieres, crocks, jars, churns, etc. A number of potters make a higher grade product of stoneware, but the majority of these use imported clays. Sanitaryware is made at St. Johns, Que., and other points; but the raw material, including clays and feldspar, is nearly all imported.

The total value of the production of pottery and clay sanitaryware in 1912, according to returns received, was $427,089, of which it is estimated that the value of $383,134 is attributable to imported clays. The total value of the production in 1911 was reported as $439,264, of which a value of $336,771 is credited to imported clays. The large falling off in Canadian production in 1912 is chiefly due to the destruction by fire of a large pottery works in Quebec.

The imports in 1912 were valued at $3,094,956, as compared with a value of $2,516,536 in 1911, and $2,283,116 in 1910. These imports are subdivided into eight classes, and in 1912 include: brown or coloured earthenware, etc., $62,161; C.C. or cream coloured ware, decorated, printed, or sponged, etc., $291,804; demijohns, churns, or crocks, $18,404; tableware of china, porcelain, white granite, etc., $2,068,362; china and porcelain ware, N.O.P., $71,751; tiles or blocks of earthenware, or stone prepared for mosaic flooring, $160,082; earthenware tiles N.O.P., $239,391; manufactures of earthenware N.O.P., $183,001.

There has been a general increase in almost all classes of earthenware and chinaware imported. Great Britain is the principal source of the imports of this class of products, but quite large supplies are also obtained from the United States, Germany, France, Austria-Hungary, Japan, Belgium and other countries.

Kaolin

A production of kaolin is reported in Canada for the first time in 1912, the total sales being 20 tons, valued at $160. This was obtained from the deposits located on parts of lots Nos. 4, 5, 6, 7 and 8 of range VI. south, township of Amherst, Ottawa county, Que., which were opened up by the Canadian China Clay Company, of Montreal.

The plant for refining the clay is situated two miles from St. Remi d'Amherst, and seven miles from Huberdeau, the terminus of the Canadian Northern Quebec Railway—ninety-four miles northwest of Montreal.

The imports of china-clay, ground and unground, into Canada during the twelve months ending December 31, 1912, were 18,332 tons, valued at $127,402, or $6.95 per ton, as against an importation of 18,819 tons, valued at $125,768, or an average of $6.68 per ton in 1911. These figures indicate to some extent at least the present actual demand for this product. The imports of earthenware and chinaware were, however, valued at $3,094,956 in 1912, and composed chiefly of tableware of china, porcelain, etc., showing the possibilities for the development of industries utilizing china clays.

Kaolin, or china-clay is also in considerable demand in the United States, the imports into that country in 1911 being valued at $1,461,068.

Discovery of a Roman Pottery

A RECENT report of the excavations at Corstopitum shows that a Roman pottery of importance was at one time established there. The remains of a house have been discovered, the northern half of which was clearly devoted to the manufacture of pottery. "In the north-east room," says the report, "two small tanks were found, constructed of flags set on edge and abutting against the north wall; they were filled with clay, apparently unworked, and a considerable heap of the same material was found near them, lying on the latter floor level, which was eight to twelve inches above the original floor, the latter being about 2 feet 9 inches below the present surface. The adjacent chamber to the west showed similar levels, and in each of these rooms, on or above the latter floor, a large quantity of unbroken pottery was found, which had evidently been manufactured on the spot from clay found in the neighbourhood. The ware was coarse, and most of it of a yellowish brick-red colour, but some fragments had been fired in a muffled kiln and showed a dull purple. Several types of vessel were represented, the most noteworthy being flat dishes, some of which had been a large size. The kiln adjoined the west wall of the second of these rooms. It was 9 feet long and 2 feet 2 inches wide, and was floored with flat tiles, 8 inches square and 1¾ inches thick; the sides were of masonry, with two flues, 6½ inches wide, on either side. Apparently the ends had been stopped and the top domed with clay at each firing, as a large quantity of burnt clay was found in the kiln, as well as broken pottery of the same character as that already mentioned; and, in order to gain access to the north end, a portion of the original north wall of the house had been taken down, and rebuilt in the space which had previously divided this house from the building on the northern half of the site. To the south of the brick flooring, and on the same level, was a floor of clay, 2 inches thick, lying on a layer of good opus siginum. The discovery is of particular interest, as confirming the indications found in previous years of the manufacture of pottery at Corstopitum; but the quantity of fragments unearthed was so large that it has been thought advisable to defer a more detailed description, which, it is hoped, will be included in a future report.

In a paper read before the London section of the Society for Chemical Industries, by W. G. Hancock, he described a new method for the testing of various physical properties of clays. He has arrived at the conclusion that the specific weight of clays is between 2.6 and 2.7. The plasticity is determined by the amount of water which it takes to make the body from the dry state to plastic moulding state. The degrees of plasticity is thus determined by the formula $a/b \times 100$, in which a represents the pounds of water used, and b the pounds of clay used. In order to test the porosity, the test pieces are immersed in water, but only in such a way as to leave the surface of the test pieces above the water in order to give the enclosed air in the test pieces a chance to escape. The time of immersion is twenty-four hours.

The Part of Clay Products in the Municipal Engineering Field

By S. Barlow Bennett, City Engineer, Nanaimo, B.C.

THE variety of topics which may be included under the term Municipal Engineering make this subject an extensive and difficult one to deal with in the short space at my disposal.

At the present time the municipal engineering field includes the construction of sidewalks, pavements, sewers, waterworks, bridges and the necessary buildings for carrying on municipal affairs, such as city offices, fire halls, schools and markets. Consequently when the part that clay products takes in these varied and important undertakings is considered, one is apt to exclaim: "Give me a few acres of clay and shale lands, together with a sufficient supply of coal, and I will erect a brick works and a cement factory. Next, supply me with efficient labor in quantity and quality and I will undertake to produce for the benefit of the community the finest city in the Dominion—equipped with good sidewalks, pavements, reservoirs, and all the necessaries required to make a city an ideal place." Strange that all these desirable and beneficial improvements can be achieved from that much neglected and maligned occupation of the clay worker—the manufacturer of clay products!

It is remarkable that clays and shales of exceptionally good quality, and in quantity of an unlimited amount, are found in various parts of Canada, but we are badly in need of records of accurate analysis, together with details of trials of the various bodies obtained by the mixing of different clays. It was through patient investigation, disappointments and stubborn perseverance that such men as Palissy, Wedgwood, Flaxman and, later, Doulton, Twyford and Minton, raised the art of the clay-worker to so high a position in the old country.

At the present moment on Vancouver Island we have several companies producing clay products. One of the most important of these is the Nanaimo Brick and Tile Works. This company is now producing some excellent clay products, as will be seen from the illustration, but the firm is just in its infancy and is frequently handicapped because the operators have not yet gained that experience which can only be obtained by chemical and geological analysis, combined with the patient working of an innumerable amount of tests and trials. Again, these undertakings can only be worked to success when the country has reached that state of development which demands substantial buildings, good roads, sidewalks and sewers, and can provide sufficient railway trackage for successful transportation.

On all sides the use of cement is increasing by leaps and bounds. It becomes the basis on which good municipal development can proceed. On cement depend good roads, good sidewalks, good reservoirs and good permanent buildings. It is estimated that a barrel of Portland cement will consume in its manufacture about 450 pounds of limestone, and 150 pounds of clay or shale. A plant making 1,000 barrels of cement daily will therefore use in the course of an ordinary year about 66,000 tons of limestone and 22,000 tons of clay or shale. Assuming the average density for these materials, a 1,000-barrel plant will use up almost 1,000,000 cubic feet of limestone and 250,000 cubic feet of shale yearly. As the investment in plant is heavy, it would be folly to locate a cement plant, under ordinary circumstances, at a point where less than twenty years' supply of raw material is in sight. A 1,000-barrel plant, therefore, should have 20,000,000 cubic feet of limestone and 5,000,000 cubic feet of clay or shale on its properties. This may appear to be a very considerable

Exhibit awarded special diploma at the Annual Agricultural and Industrial Exhibition, New Westminster, B. C.

amount, but when it is calculated that one acre—that is, a space about 40 yards by 120 yards, and this area 10 yards deep—will give 1,296,000 cubic feet, it will be readily seen that an area of about forty acres will produce all the material required for a twenty years' plant. Now compare this with the thousands of acres of clay and shale which can be found in this vast Dominion and the area required is insignificant.

Portland cement is not considered the best material for finished road construction, but without doubt it is the most useful that can be employed in forming the base of all good roads.

It has been frequently stated that "Portland cement concrete pavements for roadways are wrong in principle and a failure in practice." This may be true enough, but Portland cement concrete as the foundation for pavements for roadways is the material "par excellence." There may be many errors in the proportions used in the mixing of concrete, improper materials may be used, there may be bad foundations and lack of screening—all may lead to bad results, but no one can truly state that this is the fault of the cement.

In the construction of sewers, the clay product that is a proper proportion of clay, shale and rock shale, carefully selected, ground, mixed fired and salt glazed will produce an excellent material for the construction of sewers up to twenty-four inches in diameter, and for the formation of brick sewers of larger dimensions, especially those elliptical in section, is obtained by using an invert, well formed and constructed of vitrified earthenware, that is from the well glazed clay product. And the sewers even of large dimensions are wholly dependent on clay products. Good bricks, good cement and good labor, collectively, will produce the most desirable form of sewer.

In the formation of manholes for sewers, much more care should be exercised than is usually devoted to this detail of municipal construction. The old adage "out of sight and out of mind" is very applicable in this case, but personally I should like to see all manholes constructed of white glazed brickwork, with inverts specially designed and manufactured in white glazed fireclay. These inverts could be made all in one piece and thus any disadvantage from jointing or bad foundation could be entirely eliminated.

In Victoria there is located the B. C. Pottery Company, one of the finest plants for the production of sewer pipes. It is now in process of reconstruction having been lately burnt out and a large quantity of machinery damaged, but by February, 1914, the firm will be producing pipe again. These clay products have many excellent properties which would be hard to equal and practically impossible to excel. The clay is obtained locally, the rock shale from the mainland, while the coal is obtained from Nanaimo. The finished product is despatched to all parts of the province and as far east as Saskatoon. Of late this company have obtained sufficient orders for local developments and improvements to keep them busy for several months.

One of the disadvantages of reinforced concrete buildings is their monotony of construction, but this is now being overcome by the excellent brick frontages which are being built to all important buildings. As improvements in the manufacture of clay products proceed so will the architects take advantage of the same, and additional beauty and artistic taste will be shown by the uses to which ornamental brickwork can be adapted.

The scope of the uses to which clay products can be put is unlimited and I am looking forward with confidence to the time when our streets, sewers, business blocks and homes will not only be fireproof and sanitary in construction, but artistic and pleasing in their design. And this all because of the utility and adaptability of clay products in the municipal field of engineering.

Field Examination and Testing of Clays

By Joseph Keele, of the Geological Survey

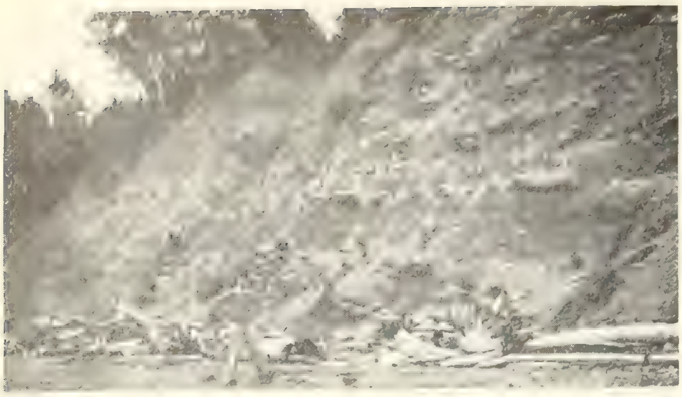
THE testing of any clay or shale for commercial purposes begins with an examination of the deposit in the field. A clay deposit should be conveniently situated with regard to transportation, in a body large enough to keep a plant going for a considerable time, free from harmful impurities, and easily worked.

There are many important questions to be considered, however, in the preliminary enquiry. For example: 1. Can drainage be provided as excavation or mining proceeds, as it is necessary to keep the workings dry? 2. Is the water supply for all purposes adequate and of good quality? 3. If sand is required for mixing, or moulding, can it be obtained cheaply? 4. Consideration of the fuel supply. 5, Are conditions in the locality favourable for labour? 6. Can breakages of machinery be repaired quickly? 7. Can the kiln foundations be kept dry? 8. Would further prospecting reveal a more desirable deposit?

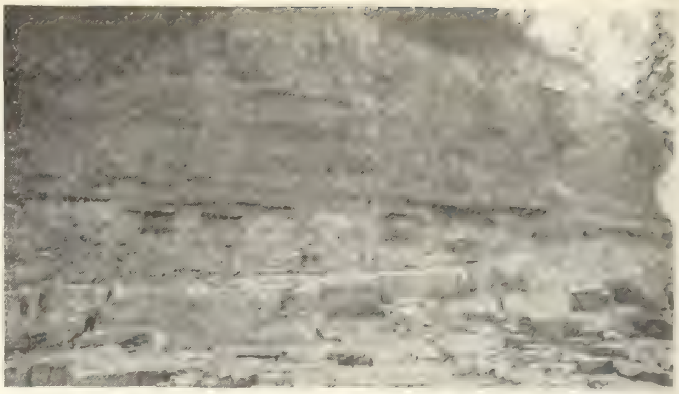
Some idea of the extent of a clay deposit may be gathered in a preliminary way from outcroppings either in plowed fields, hillsides or ridges, and along the banks of streams or dry gullies. Springs issuing from hillsides sometimes furnish a clue to the upper level of a bed of clay, as the surface water cannot seep down through it. Wells, and foundations excavated for buildings are useful guides, but railway cuttings often furnish the best information, especially when they are freshly made.

As soft clays in a steep bank are liable to be concealed by slide material which has washed down over them, it is often necessary to cut a deep trench up the slope from top to bottom of the deposit before the true character of the beds are seen. Some banks contain several different grades of clay, some of which may be worthless, and so situated as to render the good clay unworkable.

In addition to the information gained from outcrops, it will be necessary to make several borings, in order to get at the extent of the deposit and its variations. Borings can be made quickly and cheaply in surface clay deposits with a 2-inch augur, coupled to short lengths of pipe, and fitted to a crosshead. The augur is screwed into the clay for about six inches, then withdrawn with a straight pull, and the clay which clings to the augur removed. As the boring proceeds, extra lengths of pipe are added. The clay stripped from the augur is laid out in the proper



Paving brick shales, without too many stone bands, on sea coast opposite Campbelltown, N.B.



Shale beds containing too many stone bands for economic working, Richelieu River, Que.

order on boards or on the grass, from which small samples can be selected at any depth up to 30 feet or more if desired.

The clay deposit may be covered with a varying thickness of either gravel or stoney clay which cannot be used for any purpose. In most cases it will not pay to strip this overburden, if it is very thick, but the higher grades of clay like stoneware and fire clays, can have an overburden of one foot removed for every foot of clay obtained. If the overburden is composed of sand, much of it may be used for mixing with the clay, especially if it should be a fat clay with high shrinkage. An otherwise useless overburden may sometimes be used for filling or levelling up ground on which it is proposed to erect the plant, or it may be removed cheaply by hydraulicing, if a sufficient head of water is available. An overburden which contains pebbles, especially pebbles of limestone, should be removed completely, and kept well back from the face of the bank which is being worked, so that there will be no danger of the pebbles rolling into the material that is being worked for the manufacture of clay products.

Shale deposits are often exposed in fairly steep banks, either in an escarpment or on stream banks or in a railway cutting. From exposures of this kind a good idea of their probable value may often be formed. If the outcrops on the property to be examined are not exposed to any appreciable depth, it will be necessary to sink some shafts, before any sampling can be done or any decision formed regarding its economic value.

Several of the soft shale deposits in the plains region of Western Canada can be examined as easily as surface clays from borings with an augur, but the shales in the East are all too hard for this method of sampling.

The shale formation in Eastern Canada are generally uniform in character over very large areas, but those in the West are often extremely variable so that they require great care in sampling and examination.

Impurities in clay or shale are of two kinds, those which are visible to the naked eye, and those which are not. The field examination detects the first kind, and the laboratory tests should reveal the second kind. Pebbles are probably the most serious visible impurities in surface clays. They may occur sparsely scattered throughout the clay or they may be in the form of gravel streaks, pockets or regular layers. If the pebbles are mostly of limestone, the deposit is practically hopeless. Some manufacturers in search of material will not consider a deposit, if they find it contains even a few scattered pebbles.

Layers or pockets of sand, if not in too large a quantity, are sometimes beneficial in a surface clay, especially if it is of a highly plastic nature. Brickmakers like a clay bank to work itself, meaning one that carries the right proportion of sand for a proper mixture.

An excess of sand layers is undesirable in a clay deposit, because the product made from it is liable to be weak and porous, or lacking in clay bond.

Although a shale deposit may consist largely of beds of true shale, it is possible that it may also contain so many layers of sandstone or limestone as to be of doubtful economic value. If the stone bands are thick enough they may be sold for building stone if a convenient market exists for them.

Ironstone concretions, and lumps of iron pyrite are

Worthless dark clay overlying white clay in central Alberta.

Soft shales on C.P.R. through Alberta. Well situated for mining and transportation.

among the serious impurities in shales and clays. They sometimes occur of such large size that they may be discarded in mining. Gypsum or lime sulphate is a frequent impurity in the soft shales of Western Canada. It generally occurs in small glistening particles disseminated through the shale, or it may be in large crystals or rosettes. It generally follows in the West that clays carrying gypsum are hard to dry without cracking.

It is generally impossible to foretell much about the value of a clay or shale by simply inspecting the deposit in the field. An experienced clay-worker, however, can gather some information for his guidance in the selection of material. The feel of the moistened clay when kneaded in the hands indicates its degree of plasticity and its probable working qualities. A shale may be distinguished from a slate by grinding a little with a hammer and moistening it. The moistened shale dust will have more or less plasticity, but a slate will have none. Any clay or shale that carries more than about 7 per cent. of lime will probably be useless for the manufacture of vitrified wares, such as paving brick or sewer pipe. If a few drops of diluted hydrochloric acid will produce strong effervescence in a clay it may be discarded as unsuited for this purpose.

Shale cliffs on sea shore, New Brunswick. Example of easily worked shale deposit

Many clays will crack in drying, these can be easily detected by kneading up some of it with water to the proper consistency, shaping it into a rough brick or cube, and setting it to dry exposed to the sun and wind. Some clays thus exposed will crack in less than an hour after being set to dry. Others will not show cracking for several hours. If the clay dries intact, then make another brick by hand, and set it over a boiler, or in an oven at a temperature of about 150 deg. F. and observe the results. A clay must be able to stand a certain amount of abuse in drying in order to give a large output of finished products.

Since few clay or shale deposits are uniform in character throughout their entire thickness, the selection of samples for testing purposes is a matter of some importance.

If the deposit appears to be uniform, then the samples should represent an average of the depth of the face it is proposed to work. The average sample should be supplemented by two or three other samples taken from different depths, as appearances are frequently misleading in clay investigations.

Many persons pick a small sample of clay from the surface of a deposit and send it to be tested. The results of tests from this kind of sampling are generally useless, as the body of material when opened up for working may give entirely different results from the thin veneer of weathered clay overlying it. In a locality where industries have been located for a long time, working satisfactorily on a material which occurs widespread and uniform in character, the necessary information may be obtained merely by inspection of a suitable site in the vicinity of the older plants. This proceeding is often, but not always, safe where the manufacture of common bricks only is concerned. Where any of the higher class of clay products were to be made, the cheapest method is to take every possible precaution at the outset of the enterprise.

Laboratory Tests

The invisible impurities in a clay which may produce defects in the process of manufacture or in the appearance of the finished ware can only be detected by working up and burning test pieces made from the clay.

A good deal of time and money has been expended on the chemical analysis of clay, and many chemists have been rash enough to state in reports the kind of wares a clay will make, from the results of their chemical analysis alone. There may be special instances, as in the case of some high grade clays, where the chemical analysis is of value, but it is worthless for the general group of clays or shales used in the manufacture of structural ware.

Extensive shale deposit at Montmorency Falls. Well situated for mining and transportation.

What the clay-worker desires to know about a clay or shale is: 1, its plasticity and working qualities; 2, the rate of drying; 3, the exact drying and burning shrinkages; 4, the commercial limit of burning; 5, the porosity and absorption of the burned wares; 6, the actual difficulties encountered in burning, such as cracking, warping, or swelling, and scumming or whitewash.

Many of the important clay-working plants in the United States and England, especially those making a variety of wares, have an experimental laboratory, with small kilns for burning trials in charge of a competent ceramist. These firms test a large number of clay samples which are sent to them from outside sources. Three or four of the State Universities give courses in ceramic engineering and have very fully equipped clay testing laboratories. A certain amount of commercial work is done, for which fixed charges are made, according to the scope of the investigation. The tests are conducted by experienced men whose reports are reliable and extremely valuable to the person or company about to start a clay-working industry.

Most of the manufacturers of clayworking machinery have a clay-testing department on their premises.

These people invite prospective customers for machinery to send samples of their clay and have it worked up into specimens of ware. They generally make the tests free of charge. The specimens of burned wares sent back by the machinery companies to their prospective customers are generally perfect in every respect. These samples should be regarded as a standard to be ultimately attained to, however seldom reached, in the everyday world of clayworking.

Tests Under Working Conditions

If a company or individual wishes to establish an important clayworking industry at a certain place to make a certain class of wares, a reasonable way to proceed in the tests of their clay, provided the field examination was satisfactory, is as follows: Take an average sample of say 50 lbs. from top to bottom of the workable depth of the deposit, if it is uniform in appearance, or as many samples as there are different beds. Have a complete set of laboratory tests made from the samples. If the laboratory tests prove satisfactory, then make arrangements with some firm, outside the zone of competition, who are making wares similar to those required, to put a large quantity of clay through their process and to burn it in their kilns. It is important to have an experienced man do the sampling, and accompany the clay to its destination, so that he may observe the behavior of the material in the various stages of manufacture.

Example of shales outcropping at surface. Worked by steam shovel for brickmaking.

The proper location of the deposit, and the assurane of the suitability of the clay for the purpose it is to be used, are absolutely essential to begin with.

The plan of the buildings, the design of the kilns or driers, and the selection of the best types of clay working machinery, should be done by a competent ceramic engineer.

It is impossible to provide against all the troubles which may arise in new localities when dealing with a new material, but the chances for the occurence of trouble can be materially lessened by proper precaution.

The business of manufacturing clay products is a desirable one in many respects. It gives healthy employment, and produces articles of great use to a community.

It is a fairly profitable business when brains and technical skill, as well as capital, are invested in it, varying nowise in this respect from any other complex producing business.

It is just as easy, however, for the unwary novice to lose his money in a homely looking clay-working plant as it frequently is in the more spectacular operations of metal mining.

The Geological Survey has carried on a systematic investigation of the clay and shale deposits of the Dominion since 1909. The reports that are published at intervals contain complete results of laboratory tests, together with descriptions of the field occurrence, of the material collected.

They are intended as guides for manufacturers in search of suitable materials but are of general interest to all clayworkers.

Technical Trade Literature

MANUFACTURERS of materials that enter into building construction, who, as a consequence, are interested in the specification of their goods by architects, will do well to heed the fast growing demand on the part of professional men for a sharp division of trade literature—the elimination of fine writing, endorsements, "puffs" and other favorite lines of the advertising writer, so far as the literature that is designed for architects is concerned, and the amplification of real information, diagrams, technical descriptions and plans for use, the whole subjected to the acid test of "will this be useful to a man who intends to find out all there is about this material?" If trade literature does not shape up to this specification, what right has it to ask that an architect litter his files with it, asks Brick and Clay Record. The picture of a man in a smoking jacket, toasting his slippered feet at a radiator, while frost forms on the window and snow flies without, is all right for the layman, but the architect wants to know how much space the radiator occupies, what its radiating surface is, how connections are made and what pressure of steam is required to bring it up to its full efficiency. Technical booklets, technically correct, that will serve as tabulated and conveniently collected information for the architect, will be preserved and used long after the bills for their distribution are paid and forgotten. Booklets that simply tell how good the material is and who has used it (a mental club that the architect resents) frequently find their way into the wastepaper basket before more than the opening paragraphs are read.

The material of silica brick resembles that of sand-lime brick more closely than does any other material. Silica brick are made quite extensively for use as refractory linings for furnaces. They consist of sand grains, cemented together by true calcium silicate. They are prepared by mixing lime and silica in the proportion of about three to four per cent. of the former, to ninety-six to ninety-seven per cent. of the latter, subjecting to great pressure in moulding, and burning at a rather high temperature. The lime reacts with the silica of the sand forming a kind of glass which cements the sand grains together. The difference between a silica brick and a common sand-lime brick is that in the former, little time is used, and the hardening is done by firing in a kiln, while sand-lime brick contain much more lime, and they are hardened by the action of saturated steam under pressure. In silica brick, the bond consists of a glass containing no water, while in the case of sand-lime brick, the bond is not a glass, but a hydrated silicate, very much akin, no doubt, to some of the constituents of set Portland cement.

The grates in edge-runner mills for fire brick should have holes or slots not more than one-quarter inch in width, and for most purposes, one-eighth inch holes are best.

History of Vitrified Clay Sewer Pipe

Venerable Past of a Product Five Thousand Years Old Found to Embody "Modern" Principles of Manufacture

By Benjamin Brooks

BEFORE the history of Europe really began—say, approximately, five thousand years ago—there were current in the Greek "myths," or fairy tales, numerous persistent rumors of a magnificent and powerful people inhabiting a mysterious island to the south, in the Mediterranean Sea. Was it history or was it just a fairy tale?

Nobody could be quite sure which, until, less than a generation ago, a freak of the desert winds blew the sand off the ruins of Egypt's ancient foreign office and disclosed the little clay tablets whereon were recorded as plainly as in print the letters sent and received by the ancient and honorable Minister of Egypt's Foreign Affairs. Although these letters had been written and filed so many thousand years ago, it was perfectly plain to any archaeologist who glanced at them that about the time Moses was a gallant young man ready to fight any ruffian who crowded a good-looking girl out of her turn at the public well, this magnificent and powerful civilization hinted at in the Greek fairy tales really did exist on the Island of Crete.

There was bountiful trade with other countries; there was much trouble about who handled the customs receipts, and with pirates, and with encroachments of barbarous armies. But there were also huge profits and great wealth, and there was a king who was enough of a sportsman to make a Roman holiday look like a county fair on a rainy day.

Bull-fighting was the king's special delight—not such tame sport as it is nowadays, but bull-baiting without red flags or horses or weapons of any kind: just a troupe of lithe young men and women, quick as lightning on their feet, who danced before the enraged taurus, grasped his long horns as he charged them and leaped lightly over him through the air to be caught in one another's arms. Some royal sport! But the king had another and a quicker way of spending money if his gold and silver and ebony checker-board, recently discovered, is any indication. And of course he had a magnificent palace, and the best Egpytian architect imported to build it—which brings us to the hero of the story.

Palaces were a common thing with this celebrated architect, no doubt, but this palace for the Cretan king—half pirate and half patron of royal sports—was to be something extra. The ruins of it still proclaim the fact. And one of the little extras that was to make it a famous palace was the idea that it should be drained not merely with open, mosquito-ridden ditches or rough stone waterways, but in a truly up-to-date and sanitary manner with pipes. But pipes of what?

It is not difficult to see how he arrived at his choice of materials. The Egyptians had already developed the use of clay bricks. One pyramid had been built of them (and it still stands) and there were the everlasting clay tablets bearing the hieroglyphics, and clay vessels of every sort to contain wine and water. Now if a tall clay vase with a bottom in it would hold water, why wouldn't a succession of tall clay vessels without bottoms, and fitted end to end, convey running water? And this was the invention of vitrified clay sewer pipe, five thousand years ago.

The comparison of the first locomotive, the first steamboat, or the first printing press, with the last, is usually interesting by contrast, but if we take the first clay sewer pipes as they were dug from the ruins of this Cretan king's palace, still in perfect condition, and compare them with the clay pipe of to-day, we are struck by the great similarity of the two. There they are, four inches in diameter, in thirty-inch lengths, with bell-and-spigot joints, without blisters, cracks or any imperfections that would prevent their giving good service in any town of to-day.

How much did this far distant architect know and how much was he guessing? Did he realize that in creating bell-and-spigot clay sewer pipe he was giving something to the world that would be an important feature in its civilization ever afterward? Did he realize that in selecting clay for his material of sanitation he had chosen absolutely the only material that could have carried sewage and resisted its acid-bearing vapors, or carried water and resisted its solvent carbonic acid, and remained to be re-discovered after five thousand years? If an untutored girl like Cleopatra, only a few centuries later, knew that lemon juice would dissolve pearls or any other limey substance, this king's architect may have known more than we think about the destructive chemistry of sewage and the great value of burned clay to resist it. If he knew how to cut 40-ton blocks of stone from quarries without powder, float them across the Nile without tug boats, haul them across the desert without railroads, steam, donkeys or wire cables, pile them up in a temple without derricks or jackscrews, and fit them together without mortar so that not a five-hundredth of an inch

Vitrified clay sewer pipe installed 5,000 years ago by Egyptian engineers to drain the palace of Knossos on the Island of Crete and discovered recently in a perfect state of preservation.

intervened between them, it is difficult to guess how much he knew about sewerage and sanitation. It is fortunate, perhaps, that there was no regular patent office in Egypt, or we might still be paying him royalties as we do to the organized brigands of Gizeh who have come to own the Pyramids.

Now there are two sides to engineering—the Adventurous and the Commonplace. This original inventor, whoever he was, with no building ordinances to bother him, and plenty of the king's money to spend, must have enjoyed the adventure of it exceedingly. But that was five thousand years ago. To-day, the big money is to be found on the Commonplace side. The most successful engineers of to-day hire draughtsmen at $2.00 a day to invent details for them while they deal strictly in standard materials and keep their eyes on standard specifications and their fulfilment. Not being the inventors of the Briggs logarithms, a lot of us must be content to use them faithfully without alteration to the sixth decimal place—for a living. It is the same with vitrified clay sewer pipe. We did not have the fun of inventing it or using it as an experiment, but we must use it as the standard of all first-class sanitation. And, after all, there is great honor in dealing in the most indestructible material ever invented and in carrying forward the world's sanitation as well and as thoroughly as the most wonderful of all builders did for the Kings of Crete.

The True Porosity of Tile

By W. W. H. Day, Professor of Physics, Ontario Agricultural College, Guelph, Ont.

"ARE cement tile as porous as the clay tile? Will they let water through them as well as the clay? What is the porosity of clay tile anyway?" So frequent and insistent have been these enquiries since cement tile began to be used for underdrainage purposes in Ontario that we were led last winter to make a general study of the porosity of tile.

The first problem that confronted us was to determine a method of finding correctly the porosity of a tile. We knew that for comparison of porosities a method in rather general use was to determine the per cent. of water by weight that the different tile would absorb when immersed in a trough or other vessel, from which it was an easy matter to determine the volume of water absorbed, and comparing this with the volume of the wall of the tile to arrive at the apparent porosity. But, when we put a tile in water to soak, does the water fill all the pores? If not, i.e., if the air in some of the finer pores does not escape, then the porosity determined by the above method is incorrect.

To test this out we proceeded as follows: 1st. We took three whole tile, Port Dover make, dried them to constant weight and determined the volume of the tile wall, also the volume of water absorbed and from these calculated the apparent porosity by this formula:

$$\text{Per cent. of pore space} = \frac{\text{Volume of water absorbed}}{\text{Volume of tile}} \times 100$$

The average porosity of the three tile by this method was 29.6 per cent.

2nd. We took from each tile, lengthwise, four small samples, about one-half inch square and two inches long. We dried them to constant weight, and weighed them. Then we fitted a beaker with two fine wires hung down inside about an inch from the top. In the bottom of the beaker we placed about an inch of water. The sample of tile was then laid on the wires in as unstable a position as possible, and the beaker, placed under the receiver of a strong air pump and the air exhausted from the receiver. Thus the sample of tile was in almost a perfect vacuum, and hence the air was almost entirely exhausted from the pores. When the vacuum was as complete as the pump would make it, the receiver was jarred sufficiently to dislodge the sample from the wires and allow it to drop down into the water. There being practically no air in the pores the water would fill them completely. The sample was next removed, all adhering water dried from its surface by faint touch of a blotting paper, and the sample again weighed. The difference between this and the original weight gave the weight of water absorbed, from which the volume of water was known.

With the pores of the sample completely full of water it was an easy matter to find the volume of the sample. Being long and narrow it could be slipped down into a narrow graduated tube containing water. By the rise of the water in the tube the volume of the sample could be read directly on the graduated glass. The percentage of pore space was then calculated as before. The average porosity of the three tile by this method was 35.7 per cent., much higher than by the previous method.

3rd. Still another method of finding the pore space was used. Knowing the weight of the dry samples used in method No. 2 and the volume, the apparent specific gravity was determined by dividing, thus:

$$\text{apparent specific gravity} = \frac{\text{weight}}{\text{volume}}.$$

The samples, after being dried again, were ground to a very fine powder, and the real specific gravity of the powder determined, by means of specific gravity bottle. The pore space was then calculated from the two specific gravities by the formula:

$$\text{Pore space (per cent)} = \frac{\text{real} - \text{apparent}}{\text{real}} \times 100.$$

The average porosity of the same three tile by this method was 35.0 per cent., very close to the result by method No. 2.

The various determinations by the three methods resulted as in the following table:

Table showing comparison of results by different methods of determining porosity

	Porosity by absorption in atmosphere	Porosity by absorption in vacuum (four samples)	Porosity by specific gravity method (four samples)
Tile No. 1	30.5	37.8	35.7
Tile No. 2	29.8	33.6	34.2
Tile No. 3	28.6	35.7	35.2
Average	29.6	35.7	35.0

From this it is seen that the vacuum method and the specific gravity method give almost identical results, and both more than one-fifth higher than by absorption in free atmosphere. Hence we concluded that our doubts as to the accuracy of method No. 1 were well founded, and that if we wished to obtain accurate information regarding porosity of tile we must use either method No. 2 or No. 3. As the second is the simpler both in manipulation and calculation it was used exclusively in subsequent work.

It might be urged that method No. 1, while not giving the absolute pore space, would give comparative results, for the amount of air not expelled from the tile would be the same in different kinds of tile. That does not necessarily follow. We should expect that the finer the pores the more air would be imprisoned, the coarser the pores, the less air imprisoned.

Ten other Port Dover clay tile were then taken, and their porosity determined, two samples from each tile, the average of the twenty determinations showing a porosity of 35.66 per cent., a result almost identical with that already reached for the three tile. I must confess that it was a surprise to me to learn that the walls of these Port Dover tile were more than one-third air. They were not what one would term "soft" burned, neither were they hard burned—just medium. All the above tile were 4 inches in diameter.

Three inch tile of the same make showed a porosity of 31.7 per cent.

We happened to have in our laboratory at the time, for testing purposes, some four inch clay tile made at Kingsville. These were just three-quarters as thick as the Port Dover tile of the same diameter, and were burned considerably harder. Their average porosity proved to be 23.8 per cent. as compared with 35.7 for Port Dover. So we see that "porosity of clay tile" has a variable meaning, and the range of variation is considerable. Whether the great difference in porosity just noted resulted from a difference in burning solely, or from difference in clay, or difference in wetness of the clay, or difference in machinery, or difference in thickness, or from some combination of these factors we were unable to determine. Undoubtedly burning had much to do with the difference in porosity, and possibly difference in thickness influenced the burning.

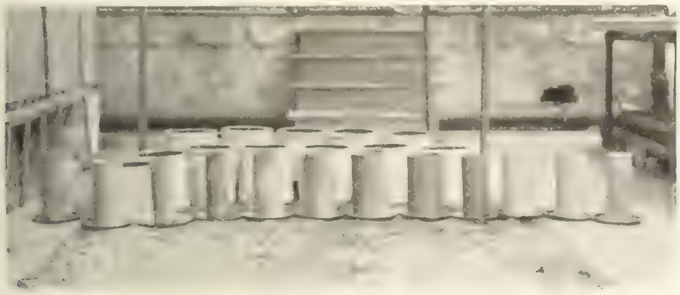


Fig. 1—Tile set in boiling pitch to seal end. Also crocks of water.

Some four-inch cement tile made at Woodstock, on a large power machine, and said to be mixed in the proportion of 1 to 4, proved to have a porosity of 22.5 per cent. Five-inch tile of the same manufacture had a porosity of 16.3 per cent., i.e., the larger tile had the smaller porosity.

With hand made cement tile, proportion 1 to 4, made on The Farmers Cement Tile Machine, the case was just the opposite, the three inch having a porosity of 22.0 per cent., the four-inch of 27.8 per cent.

A very interesting study in percolation grew out of the study of porosity, by which we were able to answer the question whether tile let the water into the drains through the pores or through the joints. Several tile of the various sizes and different makes were set in plates of boiling pitch, and the pitch allowed to cool. This sealed the bottom ends of the tile air-tight and water-tight. Figure No. 1 shows the tile thus prepared. They were next set in water (See Fig. 2), which stood near the tops of the tile. In this position they were left for a week to see how much water would percolate through the walls. At the end of one week not a clay tile of any of the different makes was full of water! The most in any clay tile was 3½ ins. At this rate it would have taken twenty days for that tile to fill with water up to the same level as the water outside. The next clay tile would have taken 23 days to fill, the others 175 days, 233 days and 234 days respectively. From this we must conclude that practically no water enters clay tile drains through the pores, it all enters through the joints.

With the cement tile we found considerable difference of behaviour even with tile made on the same machine, and of the same materials in the same proportion. Some of the hand-made cement tile shut out the water just as completely as the tightest clay tile, while others filled with water in a short time. The same is true of the power-made cement tile. On examining the specimens that behaved in different ways, we found that the difference arose from a difference in the wetness of the mortar. If it was wet enough that the packer produced a smooth watery surface on the inside, that tile wall would be practically water-tight, but if there was not sufficient moisture for this, then the tile wall would let water through readily, and the tile would fill in a short time.

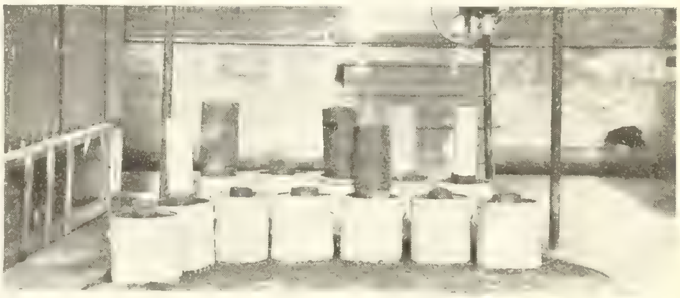
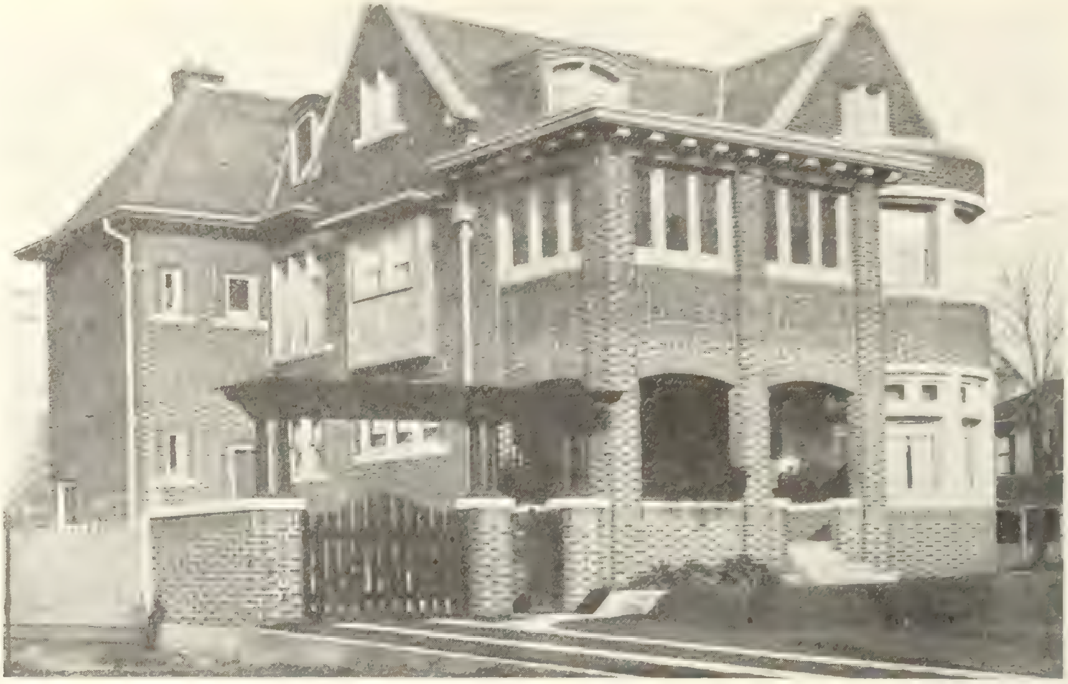


Fig. 2—Sealed tile set in crocks of water to test percolation through walls. In one week only enough water had percolated to cover the bottom of about half the tile. In the others only a few drops came through. The deepest water in any was 3½ ins.

A number of tile problems seem to cluster round the subject of porosity, e.g., strength of tile wall, and effect of frost upon tile. During the present autumn we have ordered a few tile from every yard in Ontario and hope to pursue the subject further during the winter months.

There are two methods in use for piling face brick. Some superintendents insist that brick can be handled much faster in loading them out by piling them on edge, face down, in straw. Others do this without any packing, whatever. Damp and rotting straw, however, is apt to damage the face, or if the packing is omitted, the edges chip. The foreman cannot see how the sorting is done, either—another serious objection. Another method is to pile the brick face out on the flat, two courses high. The loader will handle four brick at a time, in loading these out, two in each hand, which is about as many as if piled on edge. The brick, of course, are not damaged in any way and the foreman can watch the sorting.



Residence of Mr. T. H. Preston, Brantford Ont.

Successful Use of Tapestry Brick and English Bond in Brantford Residences

Architect : Mr. Lloyd D. Barber

IT is generally conceded that the materials employed in the construction of a building make up a considerable part of the resultant effect. Architects are constantly employing texture in surfaces for certain results. A good example is shown herewith in the residence of Mr. T. H. Preston, Brantford. The building was designed by and erected under the supervision of Mr. Lloyd D. Barber, architect, Brantford, and is considered one of the finest homes in the city. The style is peculiarly adapted to the tapestry effect, the brickwork being carried out in "Moquette" brick, the color of which is dark brown to deep red. The brick was supplied by The Black Building Supply Company, of Toronto, who were very careful to have the exact shades preferred by the architect.

The grading of brick is particularly well executed and the contractors, Messrs. Schultz Bros., deserve much credit for their efforts, which are most gratifying. The joints are about ¾-in. thick, raked out ⅝-in. deep, the mortar being light gray, gauged with cement to keep the brick setting up in place. A point in laying up this brick is to see that the mortar is rather "dry" and set up well before attempting to rake out the joints, otherwise a very dirty face work will be the result, as it is almost impossible to clean down the brick with acid or rubbing owing to the sharp, rough surface. The brick are very hard and absorb little moisture, hence the necessity of cement in a rather dry mortar. The residence is well built in every particular and is carried out in harmonious colors. The roof is mottled green slate. The stone trimmings are of Cleveland sandstone. Grey "sand-lime" brick are used for backing.

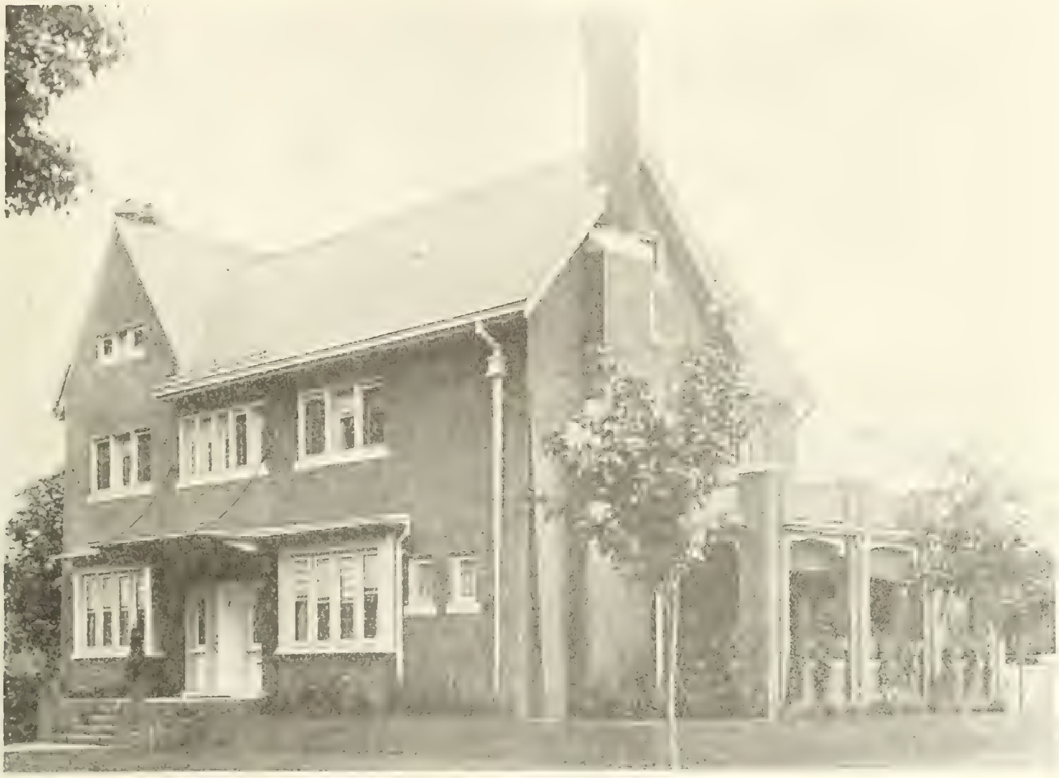
The front entrance is carefully detailed with stone pilasters. The ground floor is finished throughout in white quartered oak and mahogany and the second in whitewood trim finished in a "biscuit" shade. The mahogany doors tend rather to brown than to red tones.

The pergola at the rear entrance is very effective and harmonizes with the general effect. The whole work is hardly completed and the photo shown was taken before any planting was done. A brick and iron fence will enclose the lawn and give the whole an appearance of homeliness.

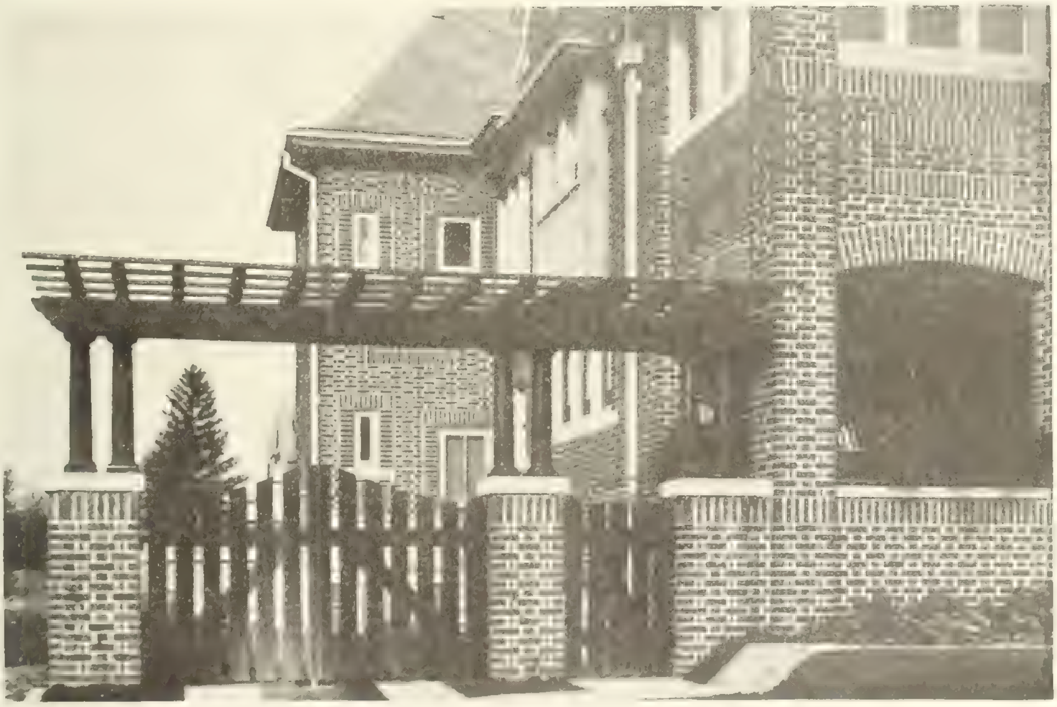
Possibilities of Stock Brick

The residence of Mr. W. B. Preston, of Brantford, is an example of the warmth in effect that can be obtained with stock brick if the design and environment will permit.

The brick employed were furnished by the A. H. Wagstaffe Brick Company, of Toronto, and chosen for their color and quality. They approach in texture the tapestry effects so much sought after by architects. The color ranges from almost green-black to deep red and brown, and as the bond is "English" with one course headers to one course stretchers, the effect in the wall is most pleasing. The desire of the architect was to keep the whole tone dark, consequently the mortar used is black with a raked-out joint. The style is "English Cottage" so familiar to those who have studied domestic work. The work is not in



Residence of Mr. W. B. Preston.



Pergola and veranda details. Residence Mr. T. H. Preston.

Tapestry Brick and English Bond in Brantford Residences

England, but it has not lost any of its charm on that account.

Special care was required in the design to keep the main rooms free from veranda shadings, and the front, which faces the north-east, is carefully detailed to this end. The veranda is on the west and south and is large and roomy, approached by French doors from both living room and dining room, accessible only from the side rear lawn, which is enclosed. The roof is in mottled green slate and is deep enough in color to carry out the color effect of the walls.

The main floor is trimmed in select black ash for the living room and den, while the dining room and hall are in dark mahogany. The second and third floors are in whitewood doors finished French gray, and mahogany trim. Though unusual, this is most effective.

Residence of T. H. Preston, Brantford. Front or Dufferin Avenue view.

The work was designed by Mr. Lloyd D. Barber, of Brantford, and the general contractors were the local firm, Messrs. Secord & Sons.

The Strength of Brickwork

IT is only natural that when a brick manufacturer has had the crushing strength of his bricks tested, he should be pleased to show to all likely customers a certificate to indicate the superiority of his bricks in this respect. It is equally right that architects engaged in the design of buildings intended to carry heavy loads, such as factories and some public buildings, should lay considerable stress on the necessity for the bricks showing a certain resistance to crushing. But of what real value are these tests, asks The Brickbuilder.

Most machine-made bricks will have a crushing strength of 2,800 lbs. per square inch, and if reasonable care has been taken in their manufacture, a much higher strength is not uncommon. Engineering bricks may easily double this figure, and in some works the average crushing strength of the bricks is no less than 4,000 lbs. per square inch.

When bricks are built up into masonry, however, the structure will not safely stand a load of more than 100 lbs. per square inch, and only with the best building bricks is a load of 210 lbs. per square inch considered safe. This is due to the fact that the mortar used in laying the bricks is, in itself, far weaker than the bricks, and it only gains strength as it hardens. Yet various investigations of ancient buildings show that lime mortar seldom, if ever, hardens completely in the interior of the joint, so that the weakness of brickwork is not due to the bricks, but to the imperfectly hardened mortar!

This drawback can be overcome by using cement and sand in place of lime and sand for the mortar, and, provided that the joints are kept thin, and the correct proportions of cement are used, this cement mortar will not prove more expensive than ordinary mortar. On the other hand, the strength of the brickwork will be increased many times, and a crushing strength of 3,800 lbs. per square inch—corresponding to a safe load of 380 lbs. per square inch—is not difficult to attain.

The use of cement mortar, therefore, provides the manufacturer of bricks with a means of showing how enormously strong structures may be made at prices to compete with the rivalry of concrete. If the matter is worked out carefully, it will be found that bricks at 27s. per thousand can be reinforced and laid in cement mortar at a cost which is well below that of concrete, provided that the building is one which will really give both materials a fair chance. Moreover, the brick building will have an admittedly better appearance than the concrete structure, and the chances of failure by electrolysis and other adventitious causes are much less. Hitherto most brick manufacturers have been content to accept the statements of other people that concrete is stronger than brickwork. As regards bricks laid in imperfectly hardening lime mortar this is undoubtedly the case, but there is no reason why bricks should be laid in an inferior mortar now that so superior a one as a mixture of sand and cement is available at similar prices.

One fact must be observed in the use of cement: it is very liable to form scum or whitewash unless the mortar is properly made, and this would disfigure the building, though even then it would not be worse in appearance than many of the concrete buildings now in existence. This scum may, however, be avoided by mixing some dust made by crushing soft, red bricks with the mortar, as this brick-dust combines with the lime set free from the cement, and not only increases the strength of the mortar, but also prevents any whitewash being formed. This method was known to the ancient Romans and Greeks, and was used by them in many of their most important buildings. They probably obtained it from the East, as broken tiles are still used in Asia Minor at the present time as a means of strengthening mortar.

There is much to be done in the way of reinforced brickwork. The pity of it is that many brickmakers are content to see trade going into the hands of the concrete makers, whereas if they only took the pains to enlighten their local builders and architects as to the advantages of reinforced brickwork over concrete in most localities, there would soon be an increased demand for bricks. The present dull season is a good time for thinking over this matter, and for getting together the necessary information on the subject.

It is necessary to prepare clay for sewer pipe in wet pans but as the wet pan is intermittent in action, the operation is unsatisfactory when applied to machines which are continuous in their action. In Germany, perforated wet pans are used, as well as perforated rolls, with success. The clay is ground in an ordinary well, then fed into the perforated machine, which forces the wet clay through the narrow slits in the perforated plates, thus giving a continuous stream of clay pugged to the best possible condition.

Face Brick in Distinctive Buildings

Interesting Examples of Successful Application Found in Recent Work at Montreal—Beautiful Work at Baltimore and Elsewhere

By E. F. Dartnell, Montreal

THE use of face brick for high-class buildings is increasing every year by leaps and bounds. Having in mind more especially its larger buildings, Montreal has been regarded in the past as essentially a stone city. In this respect, however, a marked change has come about, and it now possesses a number of costly buildings in which face brick have been largely used for the outside, as well as for interior finish.

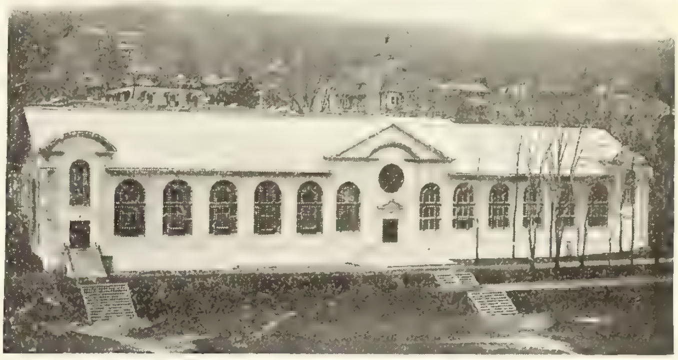
Among the striking buildings in which burnt clay in the form of brick has been used, is the new High School, on Upper University Street, near McGill University, now nearing completion. As to its principal faces the brick in this structure is a light grey or white Kittanning brick, of smooth texture, in Norman size. For the interior finish brick were used to a considerable extent, including white enamelled brick, grey Kittanning brick, somewhat similar to those used on the outside but not so light in color and of standard size, together with an ironspot pressed brick. When completed this will be one of the largest buildings in the city and as a school one of the handsomest on the American continent. The architects were Messrs. E. & W. S. Maxwell, and the contractors The Geo. A. Fuller Company, Limited.

On the same street and not far from the High School building, the new Wesleyan college is in course of construction. Messrs. Ross & McDonald are the architects, and Mr. C. E. Deakin is the contractor. This building is faced with rough-textured grey "Caledonian" brick in medium shades, laid up in Flemish bond with raked joints.

The new building for Scroggie, Limited, at the corner of St. Catherine and Bleury Streets, is a large departmental store, one of the largest in Canada. It is of reinforced concrete construction and is faced with a buff Kittanning brick. The architect was Mr. D. J. Spence and the contractors were The P. Lyall & Sons' Construction Company, Limited. This building was erected in record time for a structure of its size.

The new Southam building on Bleury Street, now nearing completion, is a large office building faced with grey "Caledonian" rough texture brick in light shades and is a very effective structure. Messrs. D. R. Brown & Hugh Vallance were the architects and the Atlas Construction Company, Limited, the contractors.

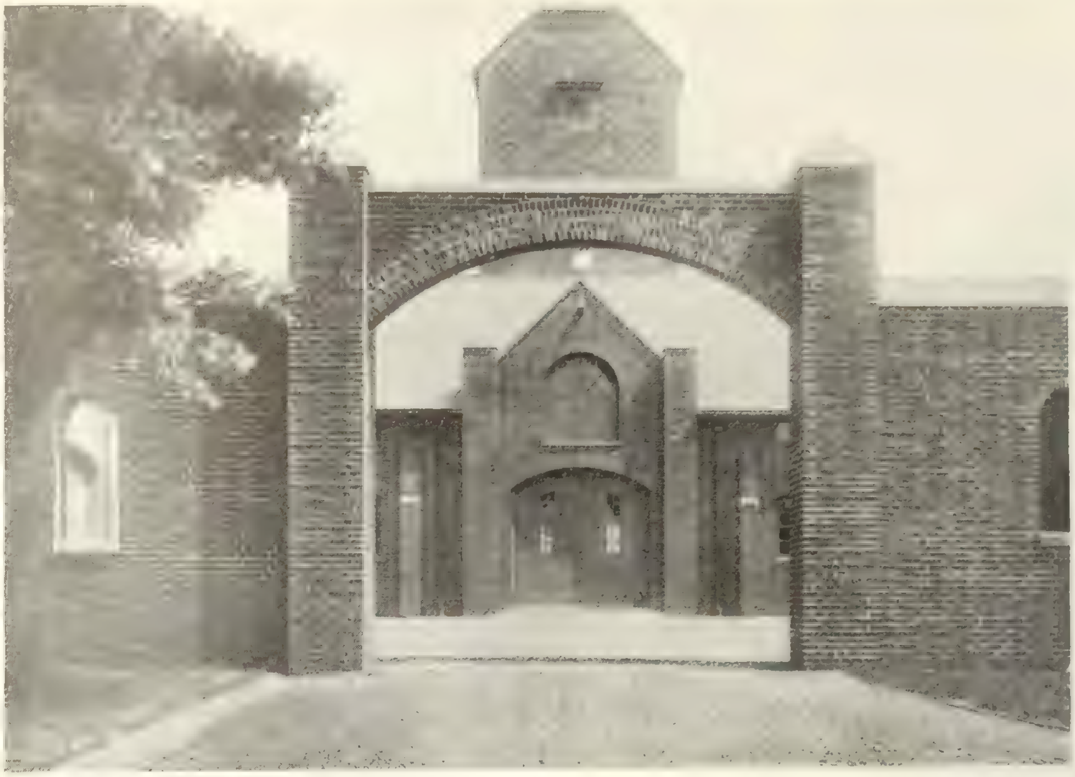
A well-designed and neat-looking building finished last year is the gymnasium of the Seminary on Cote des Neiges Hill, shown in the first illustration. The building is of but one storey, faced with a smooth light grey Kittanning brick, with a slightly mottled brick of the same make for trim, the two shades being used so as to give character to the brickwork, while at the same time requiring close observation to distinguish the two colors. The architectural work was entrusted to Mr. A. Lapierre, the contractors being Messrs. Laurent Freres.



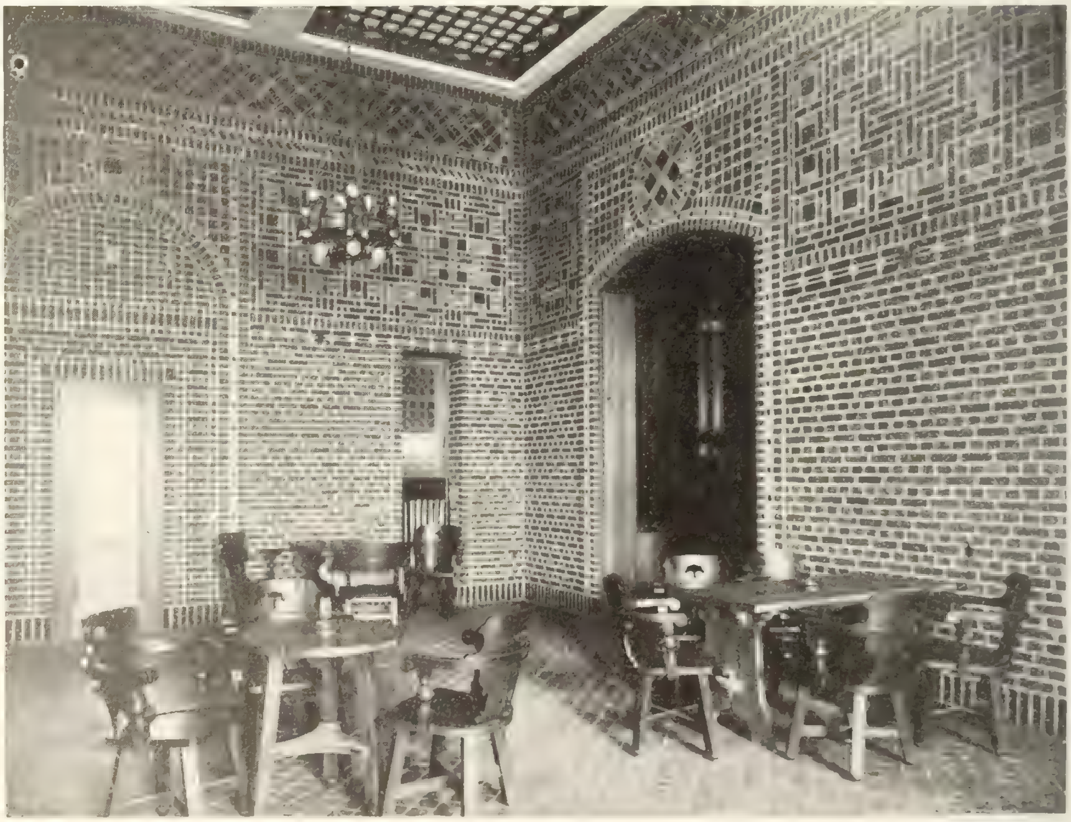
1.—Gymnasium of Montreal Seminary, Cote des Neiges Hill. Faced with a smooth Kittanning brick, light grey and mottled.

Another large building is the Strathearn school on Mance Street. The brick work in this structure is of

2.—Garage at Suffolk, Va., built of red tapestry brick.



3.—Yard entrance and garage at Topsfield, Mass. 'Tapestry' red range, special bond, grey rough cut, flush joints 3/8 ins. thick.



4.—Tap room, Hotel Belvedere, Baltimore, Md. Walls and floor of red range 'Tapestry' brick and tile.

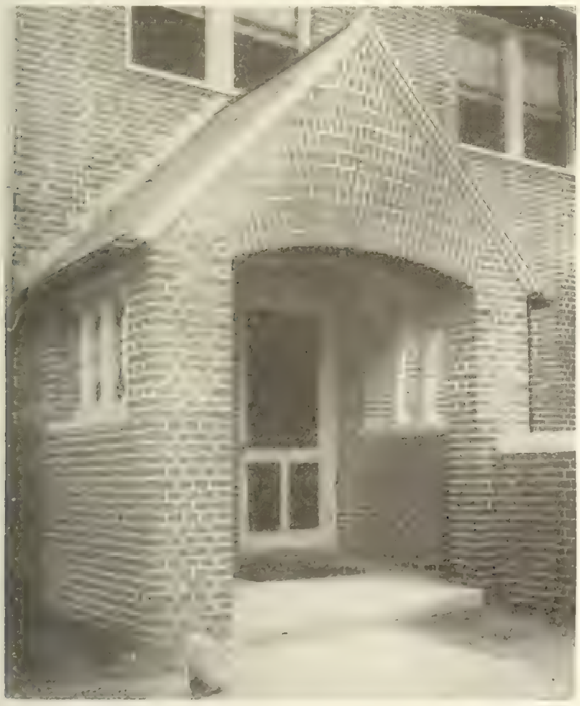
Face Brick in Distinctive Buildings

tapestry grey in the full range of color, giving it a warm, soft tone. Enamelled brick is used for the inside lining of the lavatories. Messrs. Nobbs & Hyde are the architects for this as well as several other school buildings. Messrs. Byers & Anglin, Limited, are the contractors.

A good building of the smaller class is the Montreal Water & Power Company's new pumping station on Clarke Avenue, Westmount. This is faced with golden tapestry brick in the darker shades. Mr. F. G. Robb was the architect and Messrs. A. F. Byers & Company, Limited, were the contractors.

The Read building (offices and lofts) facing on Alexander Street and covering the whole of a block, is of a light grey Shawnee brick of smooth texture. The architects were Messrs. Ross & McDonald and the contractors the Geo. A. Fuller Company, Limited.

For interior work the Montreal Light, Heat & Power Company are using considerable brick for the linings of their new buildings at Ville Emard, in the western part of the city. The lower part of the walls is of white and green enamelled brick and the upper part of light buff, semi-vitreous Shawnee brick. The architect was Mr. E. G. Robb and the contractors were Messrs. D. G. Loomis & Sons.



5.—Porch of residence at Topsfield, Mass. Red tapestry brick with grey mortar joint, rough cut flush, special bond.

For the Ste. Clothilde school, St. Henry, enamelled brick have been largely used for the lower parts of the walls of the corridors, stairways and lavatories. In color this brick is white with a dark blue band course, producing a very pleasing effect. The architects in charge of the work were Messrs. McDuff & Lemieux, the contractor being Mr. O. Archambault.

The second illustration is of a garage at Suffolk, Va., built of red, rough-textured brick. No. 3 shows the garage to the house, the porch of which is illustrated in No. 5. As will be seen from the illustration, the work is simple but very pleasing.

Illustration No. 4 shows the use of rough-textured brick for interior walls in the Hotel Belvedere, Baltimore, Md. This gives a good idea of what is being done with brick in interior decoration. The varieties used in this building were red tapestry brick and tile, the brick being laid up in Dutch bond. The general effect is one of mellowness and warmth, in contrast to the cold appearance of polished marbles. The çost, however, is about the same, or a little less than for the cheapest marbles.

The fifth and last picture illustrates an example of simple brickwork used in a striking manner in the porch of a residence at Topsfield, Mass. Note the effect of the rowlock arch carried up to the top of the porch gable. The brick used in the construction of the arch is red tapestry.

When in Washington, D.C., recently, I saw there a large building erected with a smooth texture, light grey, dry pressed brick in two shades. This was laid up in a modified Flemish bond, using a very light grey brick for the stretchers and brick a shade or two darker for the headers, the whole being laid with raked mortar joints. At a first glance you would fail to notice that two shades had been used. The effect was as though a fine lace veil had been dropped over the face of the building, taking away the harsh appearance that smooth brick generally have when appearing on a large flat surface.

Bonds in Brickwork

SEVERAL of the bonds that are now employed are described in an interesting article by H. D. Eberlien. He says the most common bonds, in fact almost the only one employed during a great part of the nineteenth century, is the running bond, in which all the courses are composed of "stretchers," that is to say, brick laid lengthwise, the only "headers" or endwise brick visible being at the window jambs, at the starting of piers and pilasters and in straight header courses at more or less frequent intervals where their use is made obligatory by the local building laws to tie the face-wall to the backing. Each course breaks joints vertically with the courses immediately above and below. Running bond is perhaps the simplest and certainly the least interesting and artistic way of laying brick and has little to commend it except considerations of economy.

The Flemish bond, in which every course consists of alternate headers and stretchers is, after the running bond, the one we most commonly meet with, having been generally used in our brick buildings of Colonial date, in which the black header and red stretcher effect is so often noticeable. Flemish bond is constructionally honest, artistic and satisfying, and its almost universal employment in modern building of Colonial style cannot be too strongly commended.

The double-stretcher Flemish bond which, as its name denotes, consists of two stretchers together, followed by a single header in all courses, the headers being laid above the joints between the two stretchers in the course next below. It is coming more and more into vogue in America and has been used in some of our largest buildings with signal success.

For the vertical joints between the contiguous stretchers, mortar colored to exactly match the brick is often used, thus making a blind joint and giving the effect of one double-length stretcher. The use of double-stretcher Flemish bond sets a big, broad scale and can be employed to advantage in large wall surfaces, particularly where it is desired to take off somewhat from the appearance of height, as the strongly marked horizontal lines have that effect. This feature can be further emphasized by slightly increasing the thickness of the horizontal mortar joints.

English bond and Dutch cross bond, like both the single-stretcher and double-stretcher Flemish bond are replete with artistic feeling and deserve to be far more widely known and used than they now are in America. Not only are they essentially artistic but they are strong and honest in structure. Both English bond and Dutch cross bond have alternate courses, the one wholly of stretchers and the next wholly of headers; but in the English bond the stretchers of all the courses come directly above each other while in the Dutch cross bond the stretchers of the first and fifth courses break joints with the stretchers of the third and seventh courses respectively and thus throughout, giving a diagonally diapered appearance if the mortar joints and the hue of the brick be judiciously contrasted.

The bonds mentioned are the most usual kinds, but one also meets with special adaptations of recognized types; it is, however, quite sufficient for general purposes to remember the five enumerated. In fact, many people, who are supposed to have some knowledge of such matters, have difficulty in keeping the differences clearly in mind and generally fall down in trying to describe them.

Interesting Examples of Old Brickwork

By George J. Jervis

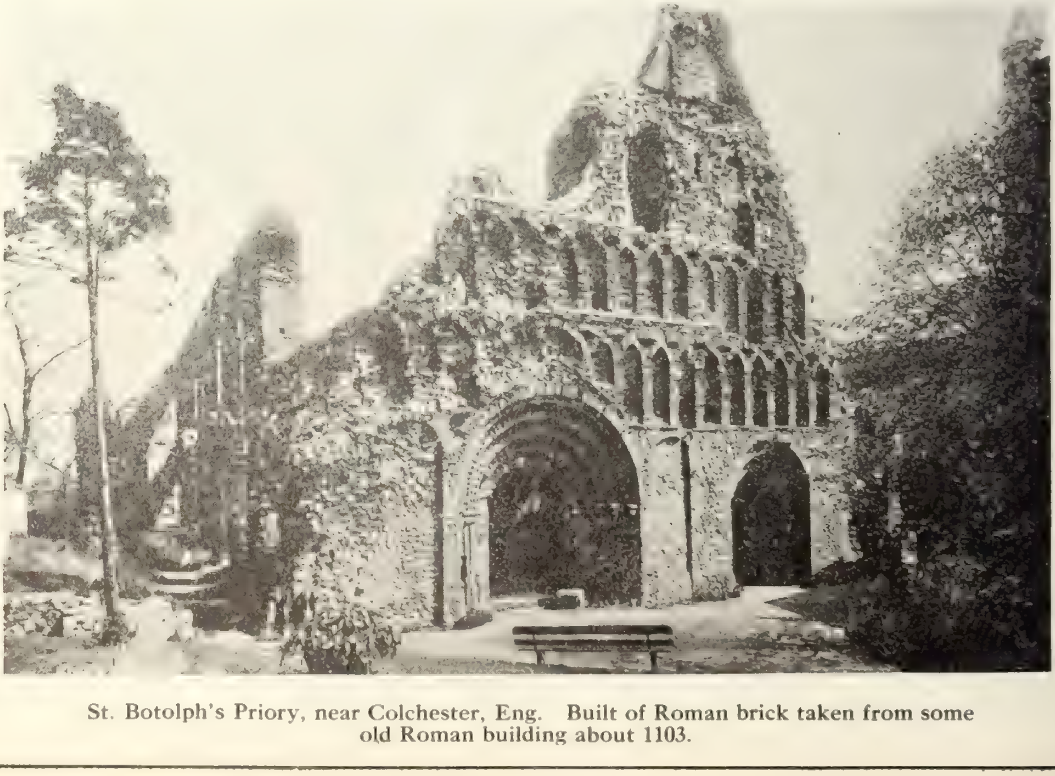
A splendid heritage of brick architecture has been handed down to us through past centuries. In the present day we have better material, increased facilities, and an unlimited field of action, all of which may well augur a bright future for brick architecture. There is a period in its history which is or should be of the greatest interest to us. That period is the introducing of brick architecture into England.

The history of English brickwork is generally supposed to date from the middle of the fifteenth century, for the few isolated examples erected prior to that time either dated from the era of Roman occupation or represented a spasmodic attempt of Saxon builders to imitate the building construction of their late conquerors. Such rare examples as St. Alban's, St. Batolph's Priory (Fig. 1) and possibly half a dozen other brick edifices, are not sufficient to establish a claim for the birth of brickwork in England, for it was not until many centuries later that the seed of brick construction was planted on English soil to blossom so speedily into such artistic creations as Eton College, Great Snoring Parsonage, East Barham and other well-known examples.

It was from the Flemish brick builders that the English received the incentive to erect their private and public buildings of a material so pliable in form and one which offered such amazing possibilities in the way of decorative treatment.

By the middle of the 16th century such examples of brick architecture as Oxborough Hall and Tattershall Castle show that the English people had not only learned the lesson of brick building from their Dutch friends but had evolved an original type as regards outline of design and details of structure.

To those whose interest in brickwork is sufficient to follow its varied historical course and to trace its introduction into England, it would be reasonable to suppose that the Flemish builders demonstrated their art more particularly in those towns on the East coast



St. Botolph's Priory, near Colchester, Eng. Built of Roman brick taken from some old Roman building about 1103.

of England to which they had the earliest access, and it must be in such a locality that we look to find the oldest existing examples of their handiwork.

The inhabitants of the seaport town of Hull, in Yorkshire, from the early part of the fourteenth century traded extensively with the Flemings and it is in this town and its environs that we find today so many interesting remains of old-time brickwork. According to Bishop Leland, the historian, Hull, in the time of Richard the Second, was completely a brick built town. In the quaint English of his day, we read—"And yn this tyme the Towne was wonderfully augmented for building and was enclosed with Diches and the Waul begun, and yn continuance ended and made all of Brike as most part of the Homes of the Towne at the tyme was." Sufficient evidence surely, that by this date the townspeople had appreciated the value of clay products as a building material of sovereign value.

One of the best examples of fourteenth century brickwork is found in Holy Trinity Church. This is one of the largest parish churches in England—its area being 20,040 sq. ft. The building is not entirely of brick, the west end being of stone but that portion of the church which is built of brick is in a wonderful state of preservation. Prominent in this respect is a buttress on the south side, east of the south transept. The sanded face of the old hand-made brick has disappeared and many of the brick show signs of weathering, which, considering the hundreds of years of exposure, is excusable. The size of the bricks in this particular section average nine inches by two and one-quarter inches and are of a dull brownish red color, the mortar joints being of a dark greyish green averaging three-eighths inch to one-quarter inch, the vertical joints being as a rule, slightly narrower than the horizontal ones.

In connection with the above, it is interesting to note that these bricks are longer and thicker than those used in Queens College, Cambridge (1448), the dimensions of the latter being eight inches by one and three-quarter inches by four inches to eight inches by two inches by four and one-quarter inches, laid with wide joints, four courses, averaging eleven and one-half inches from centre to centre. It is possible that the weathering of these particular brick is due not altogether to the chemicals in the atmosphere, but rather to the heat caused in the burning or the dampness of the clay before the brick were put in the kiln.

In a part of Hull we come across Little Lane connecting Blackfriars' Gate and Little Humber Street, which up to the seventeenth century was the only entrance to the town from the landing place on the River Humber. It is less than seven feet wide. The bricks average nine and three-quarter inches by two inches by four and one-half inches, with very uneven joints varying from one-half inch to one inch. The bricks also vary in color from a bright red to a dark crimson, some of these having the appearance of being older bricks re-used, while higher up are projecting courses of bricks of all sizes.

A later example of interesting brickwork is to be found in Wilberforce House. In the yard at the back

Great Snoring Parsonage, Norfolk, Eng. Erected late in the 15th or early in the 16th century.

Artistic old gateway showing quaint arrangement of moulded brick.

North Toronto High School.—Architects, Messrs. Page & Warrington.

of the mansion is a pavement of old Dutch tile laid in Herringbone pattern.

A short distance outside of Hull lies the ancient town of Beverly, which likewise contains many interesting examples of old brickwork. To the east of the minster are some remains of a Dominican friary, the foundation of which is obscure. But, according to Layland some contribute it as "one Goldsmith's Foundations and so of the tounes but the Lord Darcy of late tyme strove for the patronage of it with the toun." There is also a record of it in connection with some Friars Preachers in a license dated November 11, 1311.

Apropos of the above, a good deal of the history of old time construction seems to be interwoven with the two extremes of peace and war,—for it is to the ecclesiastical temperament of the times that we owe the erection of these ancient churches and monastic buildings—and it is to the military leader to whom we must credit the construction of the walls of defence and castellated buildings.

Portions of the red brick boundary wall of the old Friary, referred to above, still remain with their doorways of moulded brick in East Gate and Chantry Lane —and from the latter street one may visit several cottages constructed out of the Friary building—one with a picturesque old porch and parvise—and some panelling inside; and another with a recumbent effigy propped up against its front wall.

The artistic old gateway as mentioned is particularly interesting with its quaint arrangement of moulded brick. The bricks in this instance average ten and one-half inches by two and one-quarter inches by four and one-quarter inches with three-eighth inch to one-half inch mortar joints. They are of a very dark burnt sienna color and appear to be a loose texture, but in very sound condition. (Fig. 3).

A view of North Bar, Beverly, taken from within, shows the crow-step features of the pediment, pointing unmistakably to its Flemish origin. The date of its erection is known to have been within 1409-1410. The bricks are very similar in size to those in Chantry Lane Gateway and in color much the same as those in Holy Trinity Church, Hull.

The foregoing are a few examples only, but they will possibly suffice to prove that those of us who seek for early traces of the brick-builders' art may well leave the beaten tracks to explore with advantage these by-ways rich in example of early English brickwork, and with the historical examples handed down to us as a guide, the added interest in brick products displayed by architect, client and manufacturer, together with the improved artistic qualities of clay products of the present day, there should be no excuse for the building of brick structures other than those which are a credit to the community in general and worthy of the era in which they were erected.

North Toronto High School

OF the many fine examples of the successful use of clay products in architectural work possessed by Toronto, not the least conspicuous in point of beauty of design and symmetrical construction is the North Toronto High School completed recently. In every respect the building is admirably suited to the educational requirements of North Toronto, due care having been paid to the important details of lighting, heating and ventilation. The building is of grey stock, wire cut and red brick, with artificial stone trimmings and exceptionally fine general effect, a feature of the structure being the uniform color of the brick, which was supplied by the Sun Brick Company, Limited, Toronto. The stone trimmings were furnished by the Toronto Ornamental Stone Company and the steel work by the Dominion Brick Company. The building, an illustration of which is given above involved an outlay of $43,376, the work of construction being apportioned as follows: masonry, Mr. T. Palmer, Toronto; carpentry, Messrs. Smith & McElroy; plastering, Messrs. John Boyce & Son; plumbing, Mr. T. H. Ferguson; electric wiring, The Doyle Allen Electric Company; heating, Messrs. H. G. Waterman & Company; painting, Messrs. Hughes & Company.

Terra-Cotta and Its Proper Use as a Decorative Medium

By Philip J. Turner, F.R.I.B.A., Lecturer in Building Construction and Materials, Department of Agriculture, McGill University, Montreal

THE use of terra-cotta in its many forms is becoming perhaps more popular every day on this continent. It is to be regretted, however, that in many cases where it is used, very little regard is paid to the nature of the material, and the purpose of this article is to endeavour to state what are the possibilities of so valuable a material; also to point out what should be avoided when designing in terra-cotta, especially where it is used to form the ornamental or decorative features of a building.

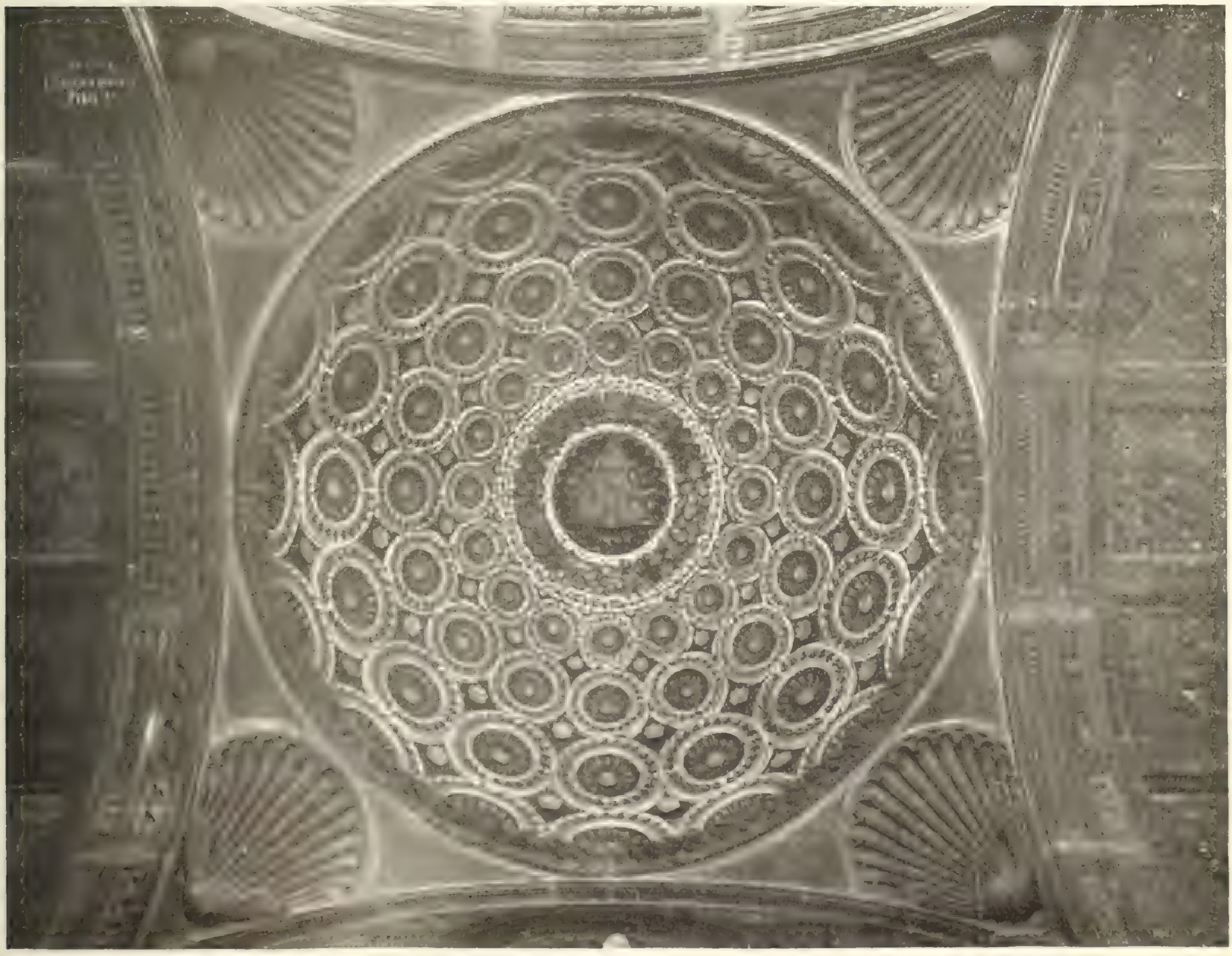
In the design of terra-cotta work, the architect should bear in mind that the material is limited principally to molding and casting. When in the kiln it is liable to warp and twist, both in the lines and surfaces, and therefore the fine delicate lines of Greek moldings cannot be attempted and bolder moldings are found necessary.

Again, the designer should never attempt to treat terra-cotta as if it were stone. Large blocks of stone cannot be imitated in terra-cotta for the more regular and closer the jointing the better the result.

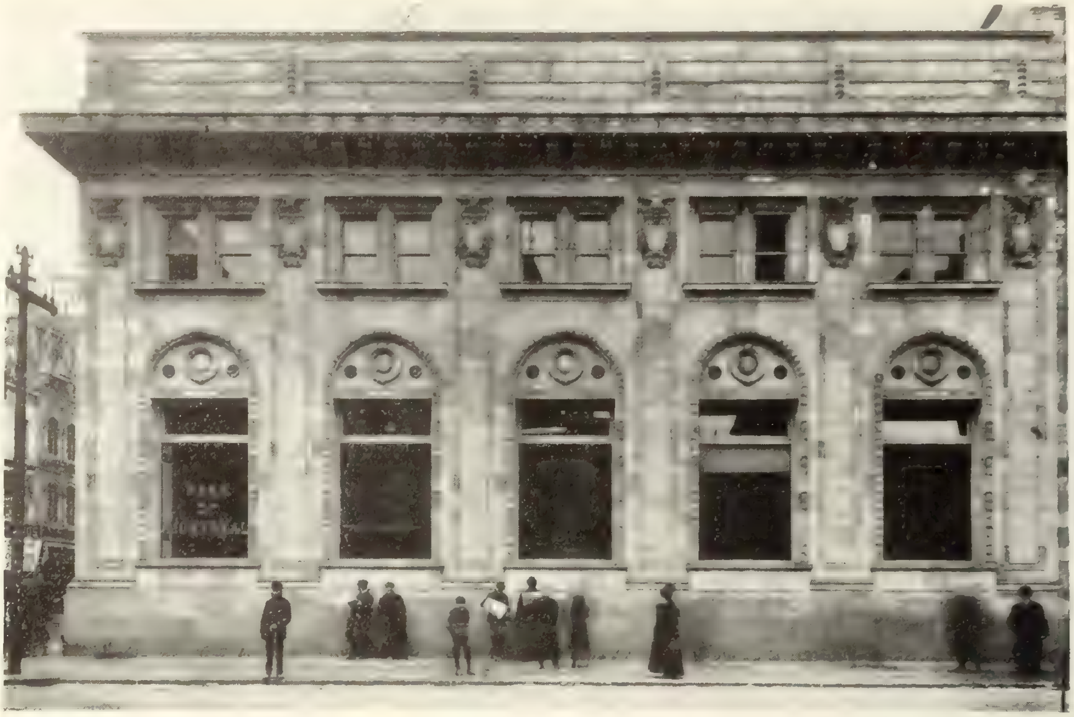
When employing this material as decoration in the form of ornament, perhaps one of the most serious errors made is the use of large projections; for this entails the use of large blocks with the added difficulty of keeping them true.

One of the greatest mistakes to which architects are susceptible is the over-lavish use of ornament in terra-cotta. The objection to extravagant ornament is that it becomes commonplace and cheap, and, as in over dress, the object aimed at is not obtained—namely, richness of effect by contrast with plain surfaces. For example, if we cut up a gable or the front of a building with enriched pilasters, panels and friezes, all repose and breadth is lost and the lines of accentuation are sacrificed.

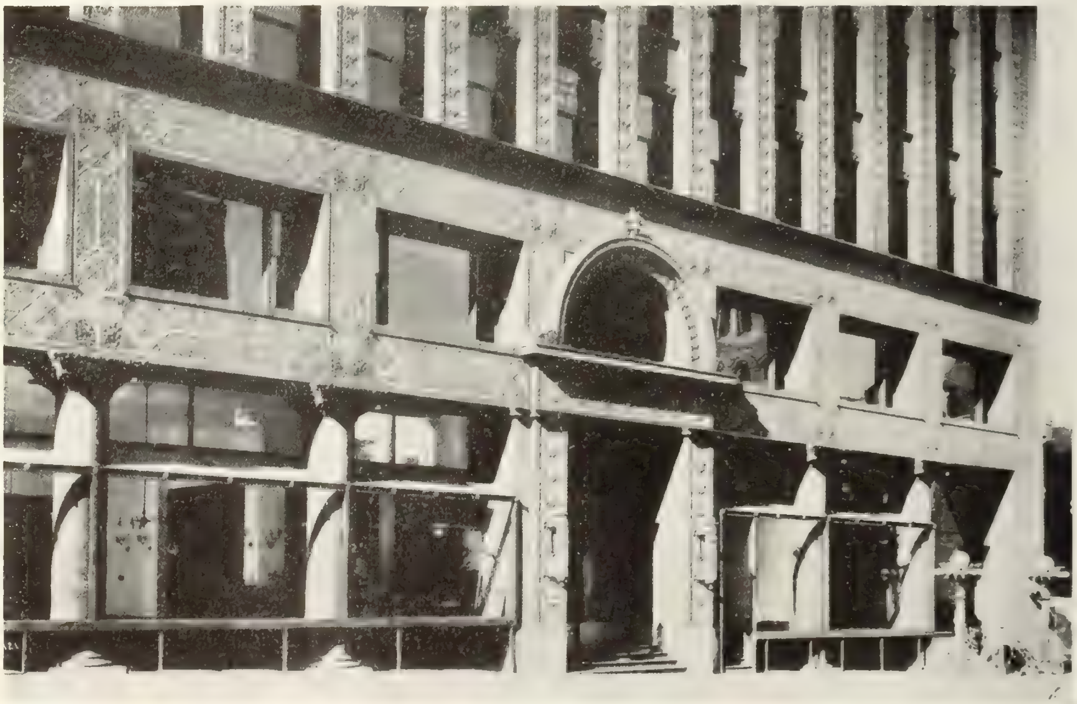
There is a mania among builders and architectural "pot-boilers" to fill in panels and wall-spaces every-



Domed ceiling of Pazzi Chapel, Florence, 1420 a.d. Interesting example of colored terra-cotta or faience. Similar treatment in stone would probably have been considered prohibitive owing to cost.



Bank of Montreal, corner Queen and Yonge streets, Toronto. Messrs Darling and Pearson, architects. The material—unglazed terra cotta—has been properly understood by the designers and treated accordingly. Note repetition of ornament without overloading. The plain wall surfaces have been relieved by the colored roundels in the semi-circles over the windows. Recognized classic features have not been attempted. Band of main cornice is relieved with flat ornamental band, taking away any unevenness from unequal shrinkage on surfaces of terra cotta. (Illustration by courtesy of Messrs. Doulton, London.)

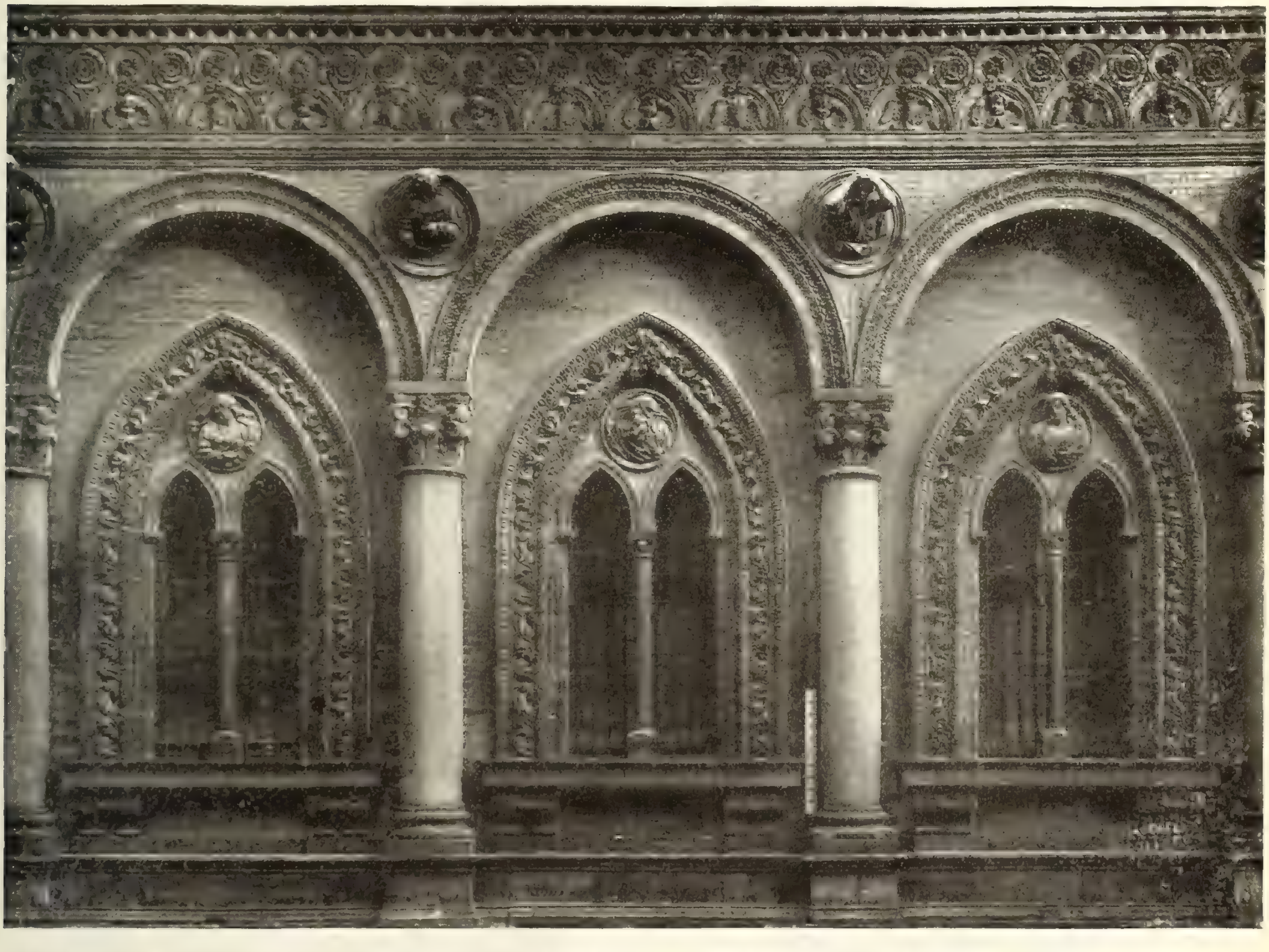


Prudential building, Buffalo, N.Y. Messrs. Adler & Sullivan, architects. All surfaces are decorated with low relief ornament most of which is repeat work. By duplicating constantly the same model can be used over and over again with little additional cost over plain blocks. Elaboration is relieved by plain jambs on the lower storeys. (Illustration by courtesy of the N.-W. Terra-Cotta Company.)

where with meaningless decoration—a practice which defeats its purpose by creating confusion rather than effectiveness.

Saloon, picture-house and restaurant builders are adepts at this kind of artistic extravagance. Ornament in terra-cotta should not be cast like stone is carved; undercutting should be avoided, and low relief, which is more adapted to the material, should be the first consideration.

Terra-cotta has been frequently misused in modern times, and in no way more so than when it has been used to imitate stone; and doubtless this is due to the fact that when first introduced into this continent it attempted to win favor by pretensions to cheapness and was used in consequence like a cheap stone. In other times and other places, where it was largely and successfully used, particularly in Assyria and Lombardy, there was practically no competition between it and other materials and consequently no temptation to employ it in a perverted manner.



The great hospital, Milan, Italy, fifteenth century. Fine example of early work. Note smallness of blocks, small projections of caps, irregularity of curved lines, low relief in ornament, and excellent modelling of roundels in spandrels of arcade.

A Rational Use of Terra-Cotta

Its lightness in weight and fireproof qualities render terra-cotta a rational and favorite material in these days for the exterior walls of skyscrapers. Such buildings, it is realized by everyone, are in the main self-supporting steel structures and merely require outside walls thick enough to act as protecting curtains from wind and weather, and terra-cotta is the ideal material for this purpose.

The Gothic architects astounded the Middle Ages with the unbounded possibilities of stone, and in this modern world of high buildings, the marvels of the steel structure seem foremost in the building world.

What is the logical reason for hiding this latter achievement—as one so often sees—under traditional masonry, as if the walls were the integral part of the building? Is it not more reasonable to use a material such as terra-cotta? This can be made to express the gradations of the steel framework and repeat its lightness and grace, for "structurability," as has been said, "has its own beauty." This does not mean the mere piling up of terra-cotta in courses as if each course upheld the next, but it does mean an intelligent application of the material to its real supports, in a way that would follow the construction, and not be simply a meaningless panelling that might be applied anywhere.

In utilizing terra-cotta in skyscrapers or other buildings, large unbroken areas should be avoided. This can be done in various ways: by setting back some courses and projecting others, or by ornamenting alternate blocks with a sunken pattern or an almost flat relief. Any such method would tend agreeably to break up an area which if left plain would magnify the unevenness of the material.

When terra-cotta is used in a decorative matter for

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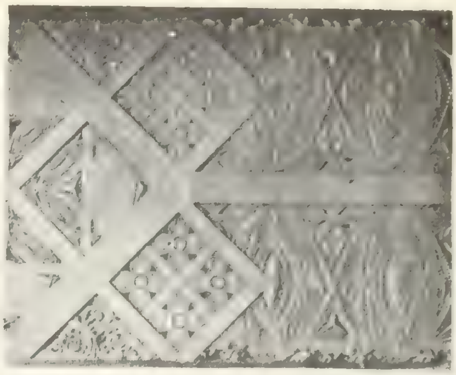

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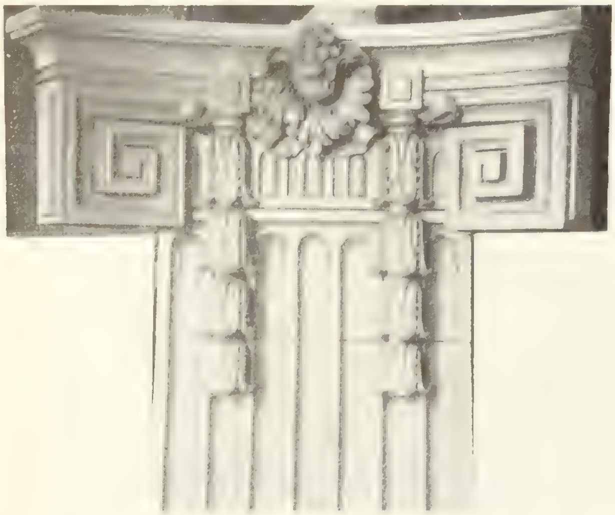

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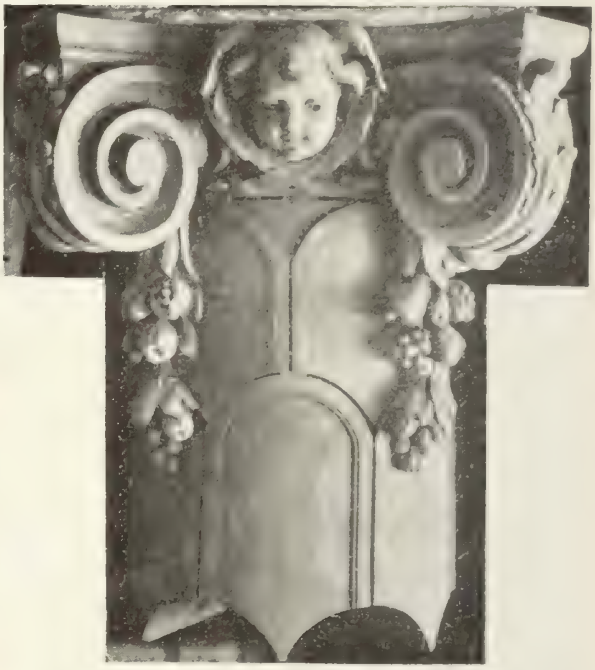

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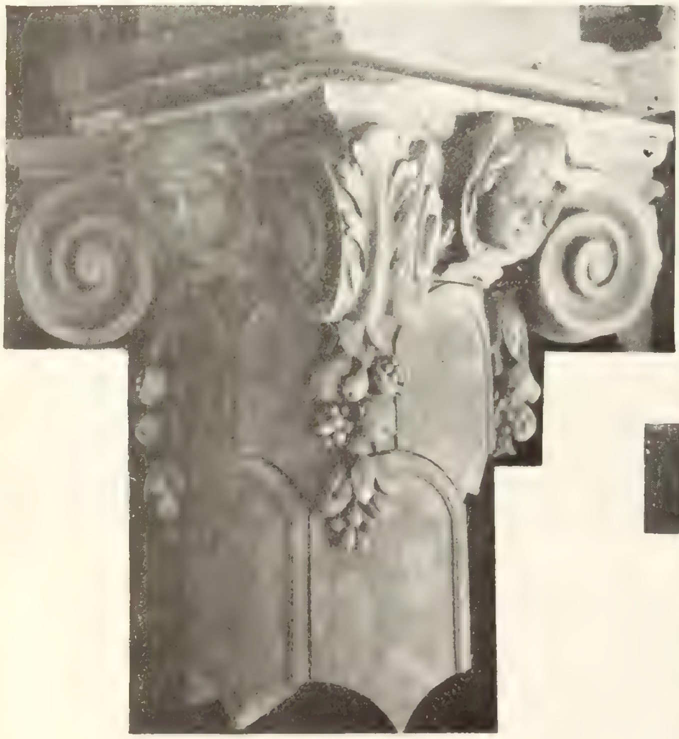

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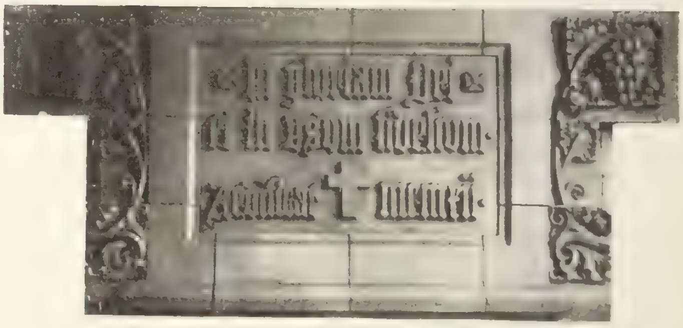

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A and B Detail of ornament in Prudential Building. Fineness and sharpness of ornament are quite in keeping with nature of material, which would not be so if stone were substituted. C—Interesting detail adapted to the material, fillets elaborated to avoid wide and uneven lines from shrinkage in burning of material. D and E—Classic columns of usual form can never be executed successfully in terra cotta owing to number of joints necessary and unevenness of lines. In these examples a cleverly designed column is shown to suit joints in material. (Illustration by Messrs. Doulton, Limited.) F—Panel from St. John's Church, Saskatoon. Note jointing of margin and panel of one piece in low relief.

the enclosing walls of skyscrapers it is often employed very clumsily, but its clumsy treatment is not always due to a perverted use of the material as a material, so much as to the unsuitability of the ornament as ornament. It would be folly, for example, to apply low relief ornament in terra-cotta to the upper storeys of a twenty-storey office building, because no ornament at such a height from the ground would be effective or clearly defined, except to the few inhabitants of the top floors of neighboring skyscrapers. This, however, is as much a mistake of architectural design as would be applicable by the same reasoning to whatever material was used. Mr. H. D. Croly, in "The Architectural Record," has stated "that terra-cotta ornament should not be used when precision, delicacy and refinement of line are required. On the other hand, terra-cotta is just as effective as carved stone, when the ornament is seen from a greater distance, and when the architect intends that its effect shall be merged in the general appearance of the building."

When buildings are not ornamented in detail the effect produced, apart from their mass, their proportions and their salient lines, must be regulated by the texture and color of the materials used. It is in the possibilities afforded by an artistic combination of texture and color that some of the greatest and most peculiar merits of terra-cotta consist.

Great strides have been made in giving a more varied texture and tone to architectural terra-cotta. For a high building, it is not ornamental detail that is required in design, but a treatment at once flat, simple, screen-like and monotonous, for terra-cotta more than any other material lends itself from its very composition to such requirements. In the best designed skyscrapers of New York and elsewhere one will find the qualities enumerated above combined. The aesthetic value of these qualities consists chiefly in the manner in which terra-cotta by its texture, color and ornamentation has assisted in bringing out the massiveness of the big buildings combined with comparative lightness.

Glazed and Colored Terra-Cotta

Besides possessing the good qualities of lightness in weight, the possibility of molding before hardening, and its ability to resist fire, terra-cotta opens up a great field owing to the fact that it can be successfully glazed and colored, serving an aesthetic purpose which cannot be arrived at in any other way by other materials. When an architect wishes color to play an important part in the exterior design of his building he has no alternative but to use terra-cotta. It is more than probable that the great future of terra-cotta in this country will be associated with its enlarged and improved use as highly colored material.

One sometimes wonders why buildings in our large cities should be so bereft of color. The fact that they have some bright color about them in contrast with the many sombre and uninspiring edifices which line the streets of our cities, will make colored terra-cotta increasingly popular. Of course serious mistakes may be made in the injudicious use and selection of color, and also of the kind of glaze selected. To this reason probably is due the timidity of architects to venture in its general use. We are told also that color is suitable only for sunny climes, and that it makes no claims to the Northerners' tastes, who favor, one might think, their "grimy hives of industry."

Successful colors can be obtained in blue, green, yellow, grey and others. A white and cream-colored dull-glazed material is being largely used at the present time, and the Carrara-ware manufactured by Messrs. Doultons of London, England, has found much favor in this country, owing to the excellence of its manufacture. This closely resembles the general texture and surface of marble. Needless to say terra-cotta that has a highly glazed surface is not to be advocated from the artistic point of view.

The Savoy Hotel, London, England, is a good example of the right use of two colors, where green bands and panels used sparingly afford a charming combination with the cream color of the walls. Parkhurst Church, Madison Square, New York, is an admirable example in which the colored glaze may be applied to buildings whose height does not make the upper storeys too remote from the eye. Every part of the building in which decoration was appropriate has been embellished with very delicate and beautifully patterned ornament, and the yellow and green terra-cotta has been used to make this shallow ornament additionally interesting.

Another advantage of glazed terra-cotta is that it can be so readily cleaned and made "to look like new." In our manufacturing cities stone and brick buildings in a few years become begrimed with soot and smoke, whereas a glazed terra-cotta building can be always washed down in a few hours with a hydrant.

Glazed terra-cotta has been adversely criticised for use in our cold climate, as in a few instances where it has been used the frost has affected the glaze and caused it to crack. The failures, however, have occurred only where an inferior make of terra-cotta has been chosen, and the lesson to be learned in this case is to insist on none but reliable material. Polychrome architecture, as a recent writer has said, is not only beautiful in itself, but it would tend to revivify our almost obliterated color sense; furthermore, it would increase public interest in buildings. Anything that will fix attention on the nation's architecture is to be welcomed and encouraged (even by the investor could he but see it) and the correct use of terra-cotta undoubtedly will accomplish this end.

There is always some uncertainty regarding what is the best material to line the chambers of a continuous kiln. In kilns in which high heat is to be used for the burning of fire brick, or high class white face brick, it is a good policy to use all fire brick. In case only ordinary building and common brick should be burned in such kiln, a good hard burned brick will answer the purpose, but it has a drawback that in case higher heat wants to be used, the kiln is worthless. In order to overcome some of this trouble, and still not go to the expense of using all firebrick, it is a good plan to use buff colored brick, which can usually be bought cheap from the face brick yards. Seconds and thirds will answer well for such purposes, and a kiln thus built will more than outlast a kiln built of common red hard burned brick.

The manufacture of pottery is one of the most important branches of the clayworking industry in the United States. During the year 1912 the value of the production was $36,504,164, according to the report of the United States Geological Survey. The increased value of the output, over that of 1911 was almost $2,000,000. Ohio was by far the greatest producer, being credited with a value of $15,508,735 and New Jersey was next, with more than $8,000,000. Six states had productions of more than a million dollars each.

The New Hotel Vancouver

Noteworthy structure embodying unusual features of design and construction. Estimated cost $2,500,00

EXCAVATION is proceeding rapidly on the site of the Granville Street wing of the new C. P. R. Hotel Vancouver at the corner of Georgia and Granville streets, and work will be inaugurated on this portion of the scheme without delay. Steady advancement is in evidence week by week on the central section of the hotel, which will be sixteen storeys high, including a roof garden. The brick and terra cotta facing has reached the upper storeys and every effort will be made to complete this part of the structure by next July.

Some idea of the tremendous amount of work involved in erecting this huge hotel will be derived from the fact that upwards of four hundred men, in addition to thirty teams, are constantly employed on the job. The heavy equipment in use consists of one steam shovel, three steam hoisting engines and two electric hoisting engines. The cost of the entire contract will be approximately $2,500,000. Upwards of three thousand tons of steel has been employed in erecting the central portion and it is estimated that altogether four thousand tons of steel will be used before the remainder of the work is completed.

The porte cochere on Georgia street will be decorated with brick pilasters trimmed with terra cotta, and in the entrance vestibule, marble mosaic and terrazzo tile will be used for the floor and ornamental plaster for the ceiling. The vestibule will contain twenty pillars, each of which is to be panelled in marble to a height of four feet and above that in Austrian oak. A similar style of wainscotting will be used for the entire ground floor. The main stairway will be finished in marble and will have solid bronze balustrades. The ground floor of the central portion is to be occupied by the main office and rotunda, ladies' tea room, banquet hall, and several private dining rooms. The first floor of the porte cochere will contain a tea room for ladies, the floor above that being planned as an elaborate suite to be reserved for the use of distinguished visitors. A large convention hall under the light court, measuring 50 x 100 feet, and surmounted with a stained glass dome, will be one of the features of the Granville street wing. Directly underneath this hall, and in the basement, provision has been made for a billiard hall of similar dimensions. The basement will also contain a large grill room, bar, barber shop and sample rooms. Space will be provided in this wing for several small stores, the C. P. R. ticket and telegraph offices and a writing room. There are four main entrances altogether, one of these leading directly to the convention hall.

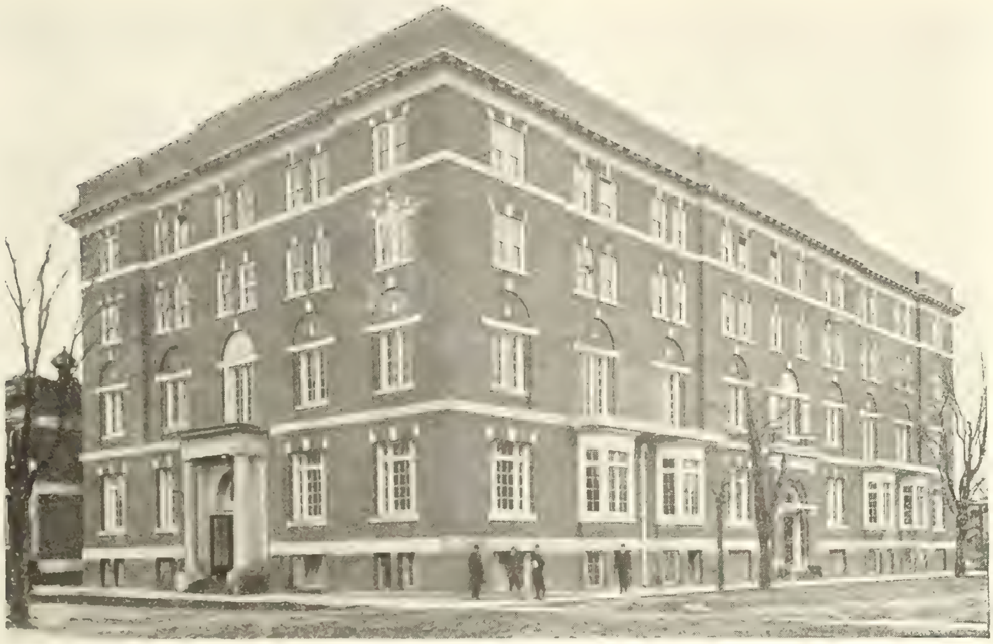
Central portion of Hotel Vancouver under construction.

The Granville street wing, the next section of the hotel to be erected, will be eleven storeys high, where it adjoins the main building, and seven storeys on the street frontage, with a light court placed directly in the centre. In order to conform with the architectural scheme of the whole building, the addition of an extra storey to the existing Howe street wing adjoining another new eleven-storey section will be found necessary. There will be seven hundred bedrooms altogether when the hotel is completed, each room being planned to have access to a private bathroom. All bedrooms will be fitted with solid oak doors and will be finished in white enamel. The hotel will be equipped with eighteen electrically-operated elevators. The roof garden on the sixteenth storey will measure 60 x 200 feet.

Progress of work at rear of central portion of new Hotel Vancouver.

The equipment and finishings throughout will be of the most elaborate description, no expense being spared to enable the contractors to erect one of the finest hotels on the continent. Mr. Francis S. Swales, architect for the C. P. R., designed the building. The general contractors in charge of the entire work are Messrs. Skene & Christie, Vancouver. It is estimated that the whole contract will be completed in January, 1915.

A firm of brick machinery manufacturers in the United States has recently introduced a new use for electricity in brickworks. This consists in separating the front of the mouthpiece and the pug-mill from each other by means of an electrically insulated collar. The negative wire from an electric dynamo or accumulator is then connected to the mouthpiece, and the positive wire to the end of the pug-mill. When the machine is at work making wire-cut bricks, a current of electricity is turned on and the amount of power required to drive the machine is reduced from 25 to 30 per cent. The electricity appears to decompose the water in the clay to a small extent and the gases developed then act as an exceptionally perfect lubricating medium, enabling an unusually short mouthpiece to be used even with the most delicate clays.



Y.M.C.A. Brantford, Ont. Architects, Messrs. Burke, Horwood & White, Toronto, associated with Mr. Lloyd D. Barber, of Brantford.

New Y.M.C.A. Building at Brantford, Ont.

Of the many architectural features of Brantford, Ont., the most conspicuous alike in point of design and construction is the new building just completed for the Y. M. C. A. of that city. This new structure, which has been most carefully designed to fulfil the requirements for which it is intended, is situated at the corner of Darling and Queen streets, forming an attractive addition to Brantford's handsome buildings.

The new structure is four storeys high with basement. The outside walls are faced with red pressed brick supplied by the Milton Pressed Brick Company, with raked out grey mortar joints, all the trimmings being of Indiana limestone. The ordinary construction is of wood joists, the floors being carried on steel frames supported throughout by steel columns. The style of architecture is very simple, following the Georgian or Colonial precedent, the aim being to secure for the building a domestic as well as an institutional character after the manner of most structures of the kind.

Commencing with the basement there are bowling alleys, billiard room, exercise room, swimming pool and the accompanying locker rooms adjacent to the pool. The size of the pool is 20 ft. x 60 ft., the water for its use being filtered by a modern filtering plant, a precaution which indicates the solicitude for the welfare of the members.

The general lobby on the ground floor is approached from the main entrance, and opening off the lobby are the reading and reception rooms.

The second floor contains a large auditorium, 80 ft. x 30 ft., which can be turned into small class rooms, or committee rooms, if desired, by means of accordeon doors. This apartment, which has a seating capacity of two hundred, is reached directly by the main staircase through the main lobby. It is being used almost every evening for purposes of amusement and instruction.

Next to this is the boys' supper room in close proximity to the main dining room and kitchen. The rest of the second floor is taken up mainly with classrooms, general toilettes and physical director's room. An innovation is to be found in the clubrooms for business men, also located on the second floor. These apartments include billiard room, lounging room and a spacious dining room, with its adjacent kitchen and storeroom. The club rooms are arranged with due attention to comfort, the aim of course being to afford the members an opportunity of cultivating the social side as far as possible.

The general lobby, the dimensions of which are 32 ft. x 62 ft., has an alcove at one end, and at the other a large fireplace which makes for the homely aspect of the building. The boys' lobby is also equipped with a fireplace. Off the general lobby is the main staircase running right through the basement to the fourth floor. Considerable space is devoted to the gymnasium. This latter is really a wing in itself occupying two storeys, the dimensions of the gymnasium being 50 ft. x 74 ft. An interesting feature about it is that it possesses a large running track in the form of a gallery.

The total area of the main floor is 13,270 square feet, of which 9,270 are in the main building and 4,000 in the gymnasium. The ground floor is finished throughout in quartercut white oak, and the principal rooms, including the lobbys, with terrazzo floors, with marble mosaic borders.

The third and fourth floors are occupied with dormitories and bedrooms, the number on each floor being thirty-two. Several suites of rooms are also provided for the use of those desiring the privacy of exclusive apartments. Shower bathrooms are installed within convenient reach of the sleeping rooms, so that nothing is left undone to cater for every reasonable requirement.

In the form of an extension a section of the fifth floor is fitted as a laundry, which is accessible from the ground floor by means of a service stair and elevator. As all the laundry work will be done on the premises, special types of up-to-date machinery are installed.

The vestibule, main entrance and the entrance to the boys' section have marble dados and stairs. The third and fourth floors are of hardwood throughout being maple and the trimming is of white wood stained mahogany.

The building is electrically lighted throughout, the conduit system of wiring being done by the Lyons Electric Company, Brantford. The power supply is derived from two return tube boilers installed in the basement by the Waterous Engine Company, Brantford, by which means also the building is steam heated.

The structure has a frontage of 149 feet on Darling Street and 78 feet on Queen Street, the total height from the street line to the roof being 58 feet. The roofing is of standard felt and gravel by the Brantford Roofing Company.

The building, which is one of the best of its kind in the country, involved an outlay in the neighborhood of $140,000. Local material was used in its construction as far as possible.

Brantford Y.M.C.A. Detail of Boys' Entrance.

Y.M.C.A. Brantford. Detail Main Entrance.

All the rooms are attractively finished and harmoniously decorated, and the whole detailed finish of the structure has been carefully handled with a view to simplicity and effectiveness.

The work has been carried out most satisfactorily by the general contractors, Messrs. Schultz Brothers, Brantford. The heating, plumbing and ventilating was done by the Drake Avery Company, Hamilton.

Messrs. Burke, Horwood and White, architects, Toronto, have given the city of Brantford a building which is a credit to all concerned, this distinction being shared by Mr. Lloyd D. Barber, architect, Brantford, who superintended this important part of the work.

Why Brick Houses Are Cheaper

AN Indianapolis architect, who was recently asked by a prospective home builder why so large a number of small houses were being constructed with brick exteriors, instead of frame, as in the past, and questioning the economy of brick construction, made the following statement, reported by Brick and Clay Record:

"There is a belief in the minds of a great many people that brick construction costs from 40 to 50 per cent. more than frame construction. Experience and investigation, however, have shown this belief to be a fallacy. The large number of brick residences that have been built during the last year have done much to establish the fact that brick is really the best material for the economical builder to use.

"An investigation of the costs of building materials with the aid of an architect will prove both interesting and instructive, especially when the brick construction is compared to the cost of frame construction. In frame construction, labor is employed in seven different instances, namely: (1) The studding, which forms the frame of the building; (2) the sheathing, (3) the building paper, (4) the weather boarding, (5) the lathing, (6) the plastering, and (7) the painting, which requires three coats to get good results. In brick construction, but two processes are necessary, (1) the brick work and (2) the plastering.

"Carefully compiled statistics show that the actual cost of brick walls over frame varies from 15 to 40 per cent., depending largely on the price of the face brick selected. As the walls of any building cost only about 10 per cent. of the total, brick construction would add only from 2 to 4 per cent. to the total first cost of the building. As it is necessary to repaint a frame dwelling every few years, it will readily be seen that brick construction, besides being the best, is the cheapest. A building constructed of brick is much easier heated than a frame one, and the saving in fuel is an item to be considered. Also, it must not be forgotten that with the faces and shades of brick now being manufactured it is possible to build a handsomer building of brick than from any other material."

The day is fast waning when architects will tell clients that it is impossible to build in brick unless an expenditure of a large amount is contemplated; experience has proven a costly teacher, but the lesson is well taught and the knowledge widely spread.

The Use of Terra-Cotta as Applied to Ecclesiastical Design

TERRA cotta as a building material has come much into evidence in this country during the past decade. Its possibilities are illimitable for exterior facing work. It is used, in the rough, for fireproofing steel, constructing floors and partitions, and also in many shapes and forms for interior finishings. That it is peculiarly adapted for ecclesiastical buildings is the purpose of this article to demonstrate.

In the first place, the general desire of the building committee of a church or similar institution is to obtain a monumental building, with certain accommodation, at a reasonable outlay. The general trend of public taste is toward a stone exterior, also—more especially in the case of an Episcopalian or Roman Catholic Church—the desire is expressed for a Gothic design. The working of stone in carving and tracery for such a composition is generally found to run to a prohibitive sum. The introduction of wood tracery into a stone-faced building, unfortunately so common in this country, is unthinkable to any student of Gothic in its true examples. Rather let the architect, if a stone exterior be insisted upon, design a building which does not call for tracery. The problem remains: how is a church to be produced, retaining the beautiful features of the old and standard examples and at the same time complying with the demand for an economical outlay? Terra cotta is certainly one reply to this question. The argument has been used, by aesthetics, that the material is an imitation. This is not so. It is a natural growth from the use of baked clay in brick form. It is a medium entirely by itself and as yet is but in its infancy.

Its possibilities are unlimited and it calls for the careful study of the architect of to-day to understand its manufacture and to discover its adaptibility to almost every school of design. Every separate block of this material, it is true, is made and finished by hand. How comes it then that terra cotta can show so much saving over stonework? The answer to this question is that the man who understands his medium can so arrange his design that the molds for tracery, modelled work, string courses, etc., call for repeats. It is very evident that this tends to economy. Again, modelled work, giving the effect of elaborate carving, can be introduced and repeated indefinitely. This work, when it is drawn from the molds prior to being placed in the kiln, is all finished and undercut by hand.

The material in question may be used in conjunction with brick or stone, or entirely by itself. In the building chosen to illustrate this article, a warm shade of buff terra cotta was selected in conjunction with a deep red facing brick from Redcliffe, Alberta. A happy combination is formed with a light buff terra cotta inclined to grey, in conjunction with a rough surfaced grey brick. Upon reference to the photographs, it will be noticed that the design of all the clerestory windows is identical, also the transept windows are similar in detail to those of the chancel and the tower: yet the effect of the whole is pleasing, and not tiring. The ornamental panels under chapel and chancel windows are repeated in the tower. The doorways on both sides of the building correspond, and the intricate modelling introduced as surrounds these entrances shows the possibilities of this material.

St. John's Church, Saskatoon. View from S.E.

The ornamental work in the upper portion of the tower and spire calls for careful consideration and earnest consultation between the architect and the manufacturer, every block in the tapering portion being made to dovetail into the block adjoining; also the same applies to the blocks above and below, provision being made for metal cramps.

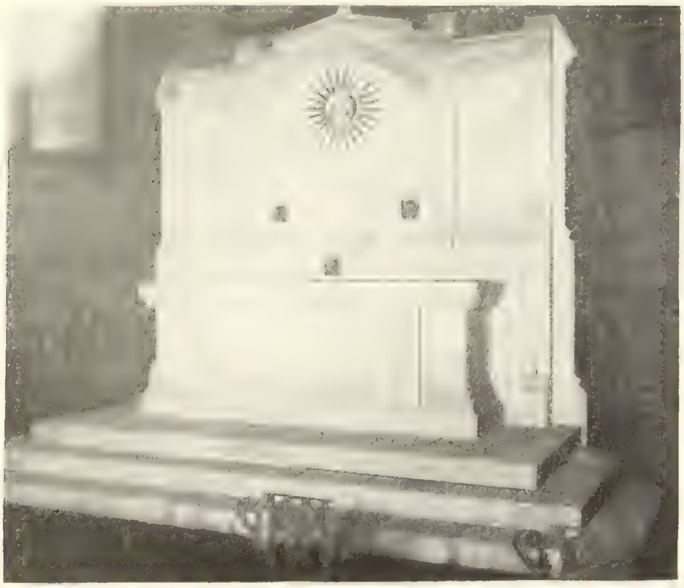
The designing of tracery calls for expert knowledge of the medium. The layout must permit of the clay being sectioned into pieces of a similar size, to prevent uneven shrinkage in the kiln, and the laying out of same, by an expert, is also a consideration, the contractor avoiding much unnecessary outlay, in centering, if the work is so sectioned that the mechanic can construct his arches without the aid of a carpenter. It is not the purpose of this article to deal with the possibilities of glazed terra cotta for exterior work or even to touch upon the vast field opened up in the question of coloured faience as applied to exterior facing.

The use of glazed work for a building of the class under consideration is not to be recommended. Let the architect select a material in which the block, both body and surface, is the same tone and colour.

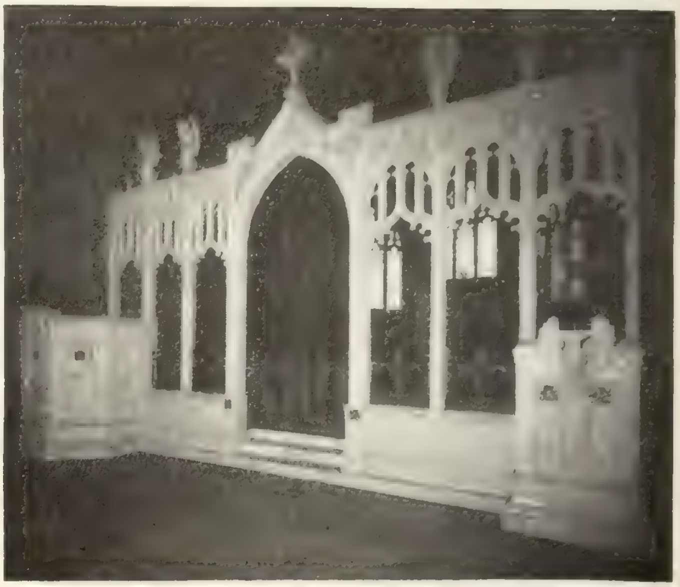
Is this material suited to a construction where it is subjected to heavy crushing strains? Yes, the blocks are made hollow with reinforcing webs designed to take the pressure. At the same time the architect, in his specification, should call for filling with cinder or breeze concrete at his discretion. This particularly applies to buttress blocks and corbels. In the case of pinnacles and projecting ornaments, these are secured by dove-tailing and dowels as in stonework.

Terra cotta is peculiarly adaptable for the interior dressings of ecclesiastical buildings. Here glazed work can be used with discretion. The tracery will naturally correspond in colour with the exterior, and the architect will be wise if he adheres to the same colour throughout, on the interior structural work.

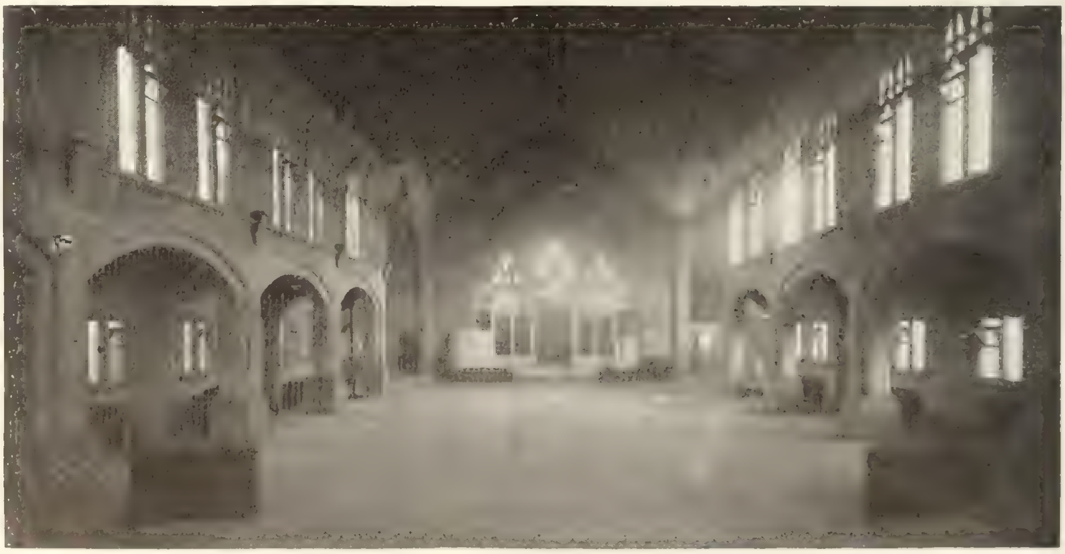
The question of the interior finish of the walls seems to call for consideration here. Why not brick again? Granted that climatic conditions are a consideration, hollow brick construction and provision of sufficient air space should easily dispose of any doubt on this point. Cathedrals in all ages were lined with



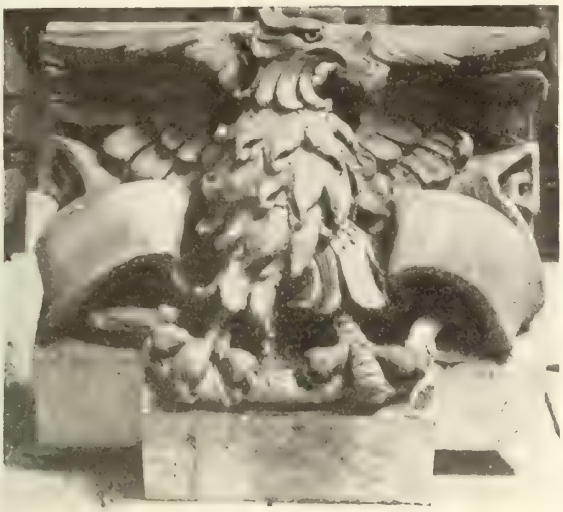
Detail of altar and reredos. Doulton carrara terra-cotta.



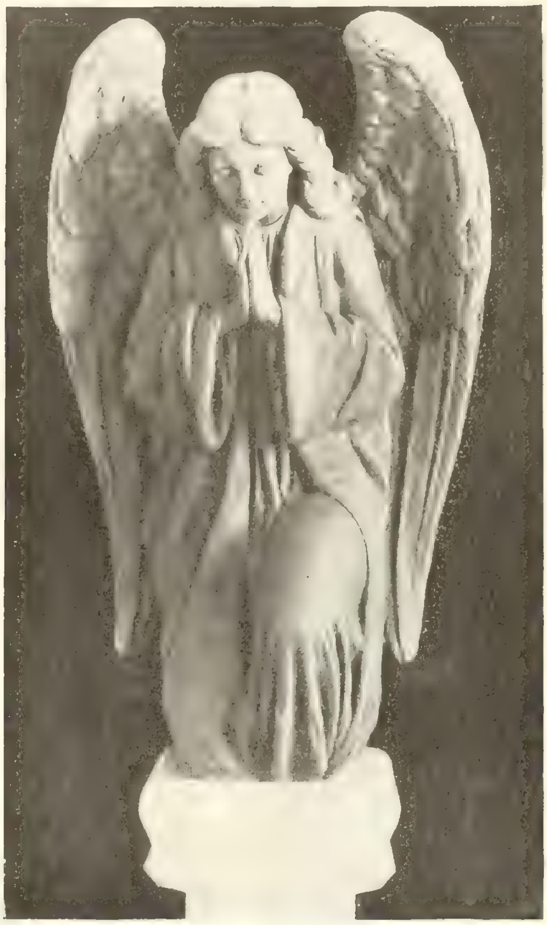
Detail of rood screen, pulpit and lectern. Doulton carrara terra-cotta.



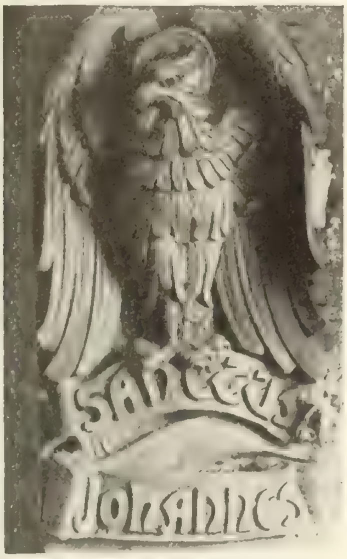
St. John's Church, Saskatoon. Interior view from west end. Roof and interior fittings unfinished.



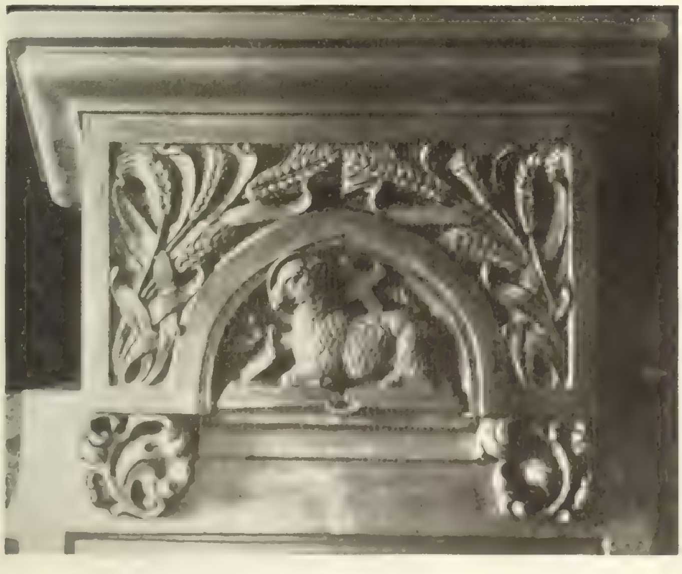
Corbel under clock in tower (exterior).



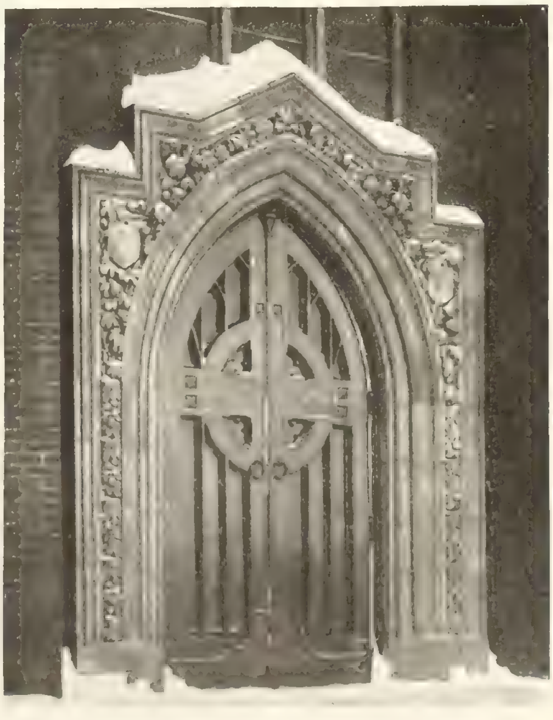
Detail, rood screen, white carrara.



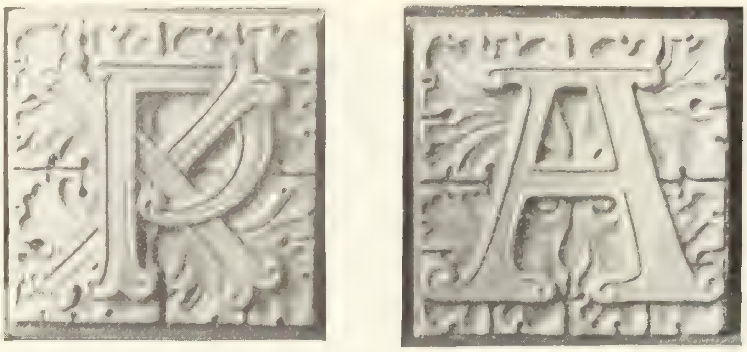
Symbolic eagle panel, east window and tower (exterior).



Pulpit reading desk.

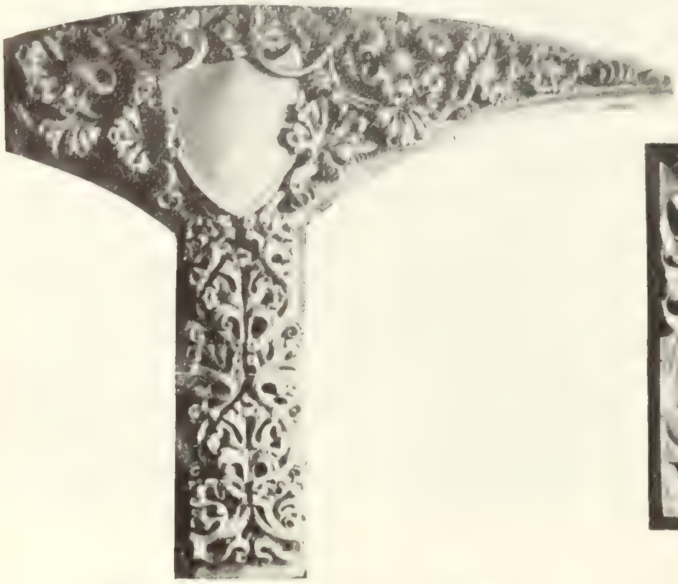


St. John's Church, Saskatoon. Detail of south transept doorway.



Ornamental symbolic tile inserts in lustre ware in reredos, pulpit, etc.

Boss at finish of label mould to windows (interior).



Ornament exterior western porches.

Ornamental panels, upper portion of rood screen.

Lectern—white carrara terra cotta.

Angel panel in reredos.

stone, churches in Europe and elsewhere have used brick interiors for generations. There is nothing more pleasing to the eye than a colonnade of arches executed in really high-class brickwork. Terra cotta is suitable introduced in the form of lofty column shafts, ornamental caps, label molds, bosses, corbels, etc. In the church here shown the interior walls are of a light buff Portage facing brick, and the structural dressings are of the same warm buff tone as the exterior. Pleasing variation can be obtained by alternating the colour of the pointing in horizontal bands, say every four or five courses. In this building the column shafts are in brick with ornamental terra cotta broaches, but, as before mentioned the material in question gives excellent results for shafts with fine moldings.

The question of fittings as apart from structure is one deserving of close attention. What architect, with a real interest in his work, but enjoys the study of an altar, reredos, font or rood screen?—furniture which can make or mar his composition. What more appropriate finish to a building as suggested above than terra cotta?

Here he has the chance to show the possibilities of Faience Work, in delicate colouring and modelling.

Sun and symbol in reredos. Background and rays in pottery gold.

The manufacturer of terra cotta, to-day, can supply any harmony in form or colour—even giving a metal finish if so desired. To refer again to the illustrations:—The material selected for the fittings was a dull glazed white finish, with spots of brilliant colour in special-made tile inserts, the whole being pointed up in white, the effect of the mass, in contrast with the general rich tones of the woodwork and other fittings, is pleasing.

The details and drawings for this work cannot be too carefully studied; every molding and finish should be detailed. Tracery should be set out in "full-size" in every case, with sections of all mullions and branches. Mullions should be designed in two sections, interior and exterior, with vertical joint in glazing grooves, and horizontal joints to assure rigidity. Intersection of all moldings should, in every case, be carefully projected.

All modelled work should be drawn in light and shade with charcoal or colour, and plentiful sections should be given.

The architect in his specifications should call for photographs of all modelled work, to be submitted by the manufacturers before the clay is kilned, and also for setting plans, showing the number and position of every block, to be delivered prior to shipment of the material. Also he should provide for the careful checking of every shipment, with prompt ordering of missing blocks, or any remakes necessary from breakages, chipping, etc.

The illustrations accompanying this article are from photographs of St. John's Episcopal Church, Saskatoon, erected during the past year from plans prepared by Messrs. Thompson, Daniel and Colthurst of that city. The entire detail throughout is the personal work of Mr. T. Brammall Daniel. The general contractors are the Geo. H. Archibald Company, Limited, of Winnipeg and Saskatoon, and the cost of the completed structure will be in the neighbourhood of $126,000. The contract for the terra cotta was let to Messrs. Doulton, Limited, of London, Eng., for $16,160, including freight and duty.

An Electrically-Operated Plant at Inglewood, Ont.

ONE of the few modern clay-working plants operating in the neighborhood of Toronto is that of Shale Products, Limited, which is located at Inglewood, on the Hamilton-Allendale branch of the Grand Trunk and the Teeswater branch of the Canadian Pacific Railroads.

The company was organized in 1912 by Messrs. T. H. Graham, J. M. Scott and J. R. Scott, all of Inglewood. In building, designing and operating the plant they have associated with them Mr. M. B. Cheney, ceramic engineer, graduate of the Ohio State University, who has had extended experience in the manufacture of clay products.

About three-quarters of a mile below the plant on the Credit River is located the company's hydro-electric power plant. The site was originally that of a flour mill and the company has built a new dam and installed a complete new outfit. The turbine is the vertical type, was supplied by Messrs. Chas. Barber & Sons, of Meaford, Ont., and is the largest they build. This is controlled by a compensating type Woodward governor, which takes care of any fluctuations in the load. Connected to the turbine by an eight-ply by 24-in. Leviathan belt is a 125 kv.a. generator. This generates 2,300 volts, and together with the motors at the plant was supplied by the Canadian Westinghouse Company, Limited. The transmission line to the factory is No. 6 bare hard drawn copper wire.

The electrical installation at the consuming end consists of three 30-watt transformers and one small transformer for lights, two large and three small motors. The three larger transformers step the voltage down to 550 volts for use in the small motors. The latter are used in operating conveyors, pump and fan.

The machinery driven by the larger motors is divided into two units. The first of these is made up of three drypans and three thirty-foot elevators. The motor here is 2200 volts, 125 h.p. The second unit is made up of the brick machine, pug mill, cutter table, tailings conveyor, and clay feeder, and is driven by a 2200 volt, 150 h.p. motor. In the case of the large motors the winding is direct to the transmission line.

The company's shale deposits cover an area of two hundred acres, the outcrop beginning west of the plant and extending to the top of the Niagara Escarpment, a distance of three-quarters of a mile and an elevation of 300 feet. This embraces the red burning Medina

Continuous kiln under construction at Inglewood.

Machine room, showing pug mill, brick machine and tailings conveyor.

shales, the cap being freestone and brownstone. This material lies close to the surface and in mining it there is practically no stripping.

At present this material is being teamed into the plant, but to complete the design a tramway will be built and provision made for ample storage in order to operate the year round.

The factory buildings are low and very conveniently arranged. The dry grinding is done in three heavy duty dry pans. These are set on full gravity setting and empty into 30-ft. center chain elevators. These in turn discharge over three piano wire screens, the screened clay falling direct into a large storage bin, the tailings returning to the dry pans. The storage bin holds enough clay to make 150,000 brick. The ground clay feeds onto a 50-ft. center to center horizontal conveyor. This is built of frictionless troughing rolls, steel frame work and squirrel cage pulleys. The belt used is a 24-in. six-ply Leviathan. By a large chain elevator the clay is delivered to the clay feeder, the storage capacity of which is five hundred cubic feet. From there the clay is run through a 16-ft. pug mill and the "999 Special" brick machine. A side-cut automatic cutter finishes the machine work on the brick, and they are hacked onto double-decked dryer cars. All imperfect brick are conveyed back to the pug mill and worked over, which is the first step in sorting, in order to secure a high-grade surface and true shape.

The drying takes place in a coal fired radiated heat dryer, there being twelve tunnels with a holding capacity of 100,000 brick. This type of equipment affords the most accurate means for controlling all drying factors, which assures added efficiency.

The brick on the cars are placed on a transfer car and run into the chambers to the setters on portable track. The transfer track forms the axis of the plant, running entirely through it and affords a simple and rapid means of moving all material.

The burning takes place in an eighteen chamber producer-gas fired kiln. This is the most convenient type of kiln in use as well as being one of the most economical. All the factors that lead to the best results in burning are under full control. The producer-gas plant has four pressure producers and a coal storage with a capacity of four hundred tons. It is conveniently located along the Grand Trunk siding so that there is but one handling of all coal. Next to the producer building is a small building containing two fans and a small boiler. The boiler supplies steam to the producers, to a small vertical high speed engine on one of the fans and also to the factory. There are two fans, one driven by steam, the other by a motor, either of which is of sufficient capacity to give good draft to the kiln.

On either side of the kiln is a stock yard, that on the east side being along the Canadian Pacific siding, while the one to the west is along the siding of the Grand Trunk.

The machinery, dryers and kiln were supplied by the C. W. Raymond Company, Dayton, Ohio. Most of the belting was furnished by the Main Belting Company of Canada, Limited. The brick work on the kilns and dryer was done by Messrs. J. H. and G. S. Warwood, brick contractors. The fire brick were supplied by the Elk Fire Brick Co. of Canada, Limited. All frame buildings, all excavating, and concrete work have been done by the company.

The modern equipment and excellent shipping facilities of this company place it in the front rank of up-to-date Canadian plants for the manufacture of high-grade vitrified brick out of the Medina shales.

View at drawing end of dryer.

Interior of power house, showing governor, gearing and exciter.

Brick Plants of the Twentieth Century

A Consideration of Possible and Practical Economies—Utilization of Waste Heat—How the Manufacturer's Profits are Burned Up

By Charles A. Millar, Toronto*

IN dealing with this topic one must of necessity go back to earlier days and note the gradual evolution which has taken place in brick-making and brick plants. We do not propose to make the brick yards of Egypt a background for this article, but will merely revert to one short generation. Even that in fact is unnecessary, for to many of our readers there will immediately loom up a vision of horses going the weary round of grinding out the clay, and the men with wheel-barrows bringing it to the machine. To many this may seem a travesty on brick-making of to-day in our large cities where we have powerful machines turning out from 25,000 to 100,000 a day. It was only the demand for more brick, however, that foisted these modern appliances upon us, otherwise we should still be on the old tread-wheel; moreover the brick plant of the future must be different from any that has yet been seen, and indeed there are indications that some of our more aggressive manufacturers have started along these lines already. We make the following observations in the special interest of plants in close proximity to large cities.

The modern plant must be spacious, bright and clean, economical, smokeless and noiseless. How, it may be objected, could these qualities be attained around a plant where one's very existence depends on dirt, smoke and noise? In many plants built some years ago the idea seemed to prevail that to exclude all light except what was admitted through the crevices was the proper thing to do. What a relief, however, it affords one to walk around a plant such as the Don Valley (Toronto) or Mr. John Price's new plant (Toronto) where these essentials have all been taken into consideration! Think of the different conditions for the man who has to do the real work!

Not the least important feature of brick-making plants is economy. It is said that in the United States alone every year ninety million broom handles are thrown away, and that, too, in the face of depleting forests and scarcity of timber. But when one considers the fuel waste around our yards the broom handles vanish into ashes in comparison. Is there not some sane method of utilizing all the heat we must of necessity have for drying and burning our wares? Enough heat is wasted from our kilns to dry all the products we manufacture were it used in the right way along the line of radiation. Not infrequently the steam plant is old and shaky and requires more coal as a steam producer than does a new one. The steam pipes leak at the joints—more coal; the fan is half choked up with dirt and grease so that it throws only about half the air it should—more coal; the ducts leading to the fan are open or cracked and we cannot understand why we are not getting better results, and all the time the fireman is shovelling your profits into that insatiable furnace. One is inclined to the belief that the plant of the future will be run by electricity and every particle of heat will be utilized until after it has travelled perhaps hundreds of feet under ground and every heat unit extracted for our benefit in drying our wares.

Mr. Chas. A. Millar.

Then, again, what shall we say of the waste in burning brick? One calls to mind the picture of the stage coach travelling for weeks to get a glimpse of the last pine tree in Canada. It is loaded with tourists who have travelled thousands of miles to see this relic of past ages. You hear the driver explaining that years ago the ground was covered with these great trees, but that bush fires and lumbermen kept on chopping and burning until only this one remains. The brick man also got his share, for he would consume from half to one cord for every thousand bricks burned. What shall we say of such waste to the future generation? Take for instance an up-draft kiln containing three thousand bricks. As soon as set and scoved from ten to fifteen cars of wood are piled around it and the burning begins. For five days at least men are ever ramming in the wood. As soon as the heat passes through the brick it is gone. In this way we are only burning the surplus profits which at the end of the year have frequently disappeared in similar manner with the heat. In comparison with this we have the latest type of gas-producer kiln where the gas is extracted from coal and every unit of heat is conserved until it has passed through the burning chamber, heating the next one and steaming a third; and while this type is ideal (especially from the salesman's point of view) it is as yet a rich man's kiln. There is not the slightest doubt that in some respects the gas producer is a perfect kiln, but there are still defects which must be remedied before one can

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*President Canadian Clay Products Manufacturers' Association.

Typical example of an up-to-date gas producer kiln.

obtain as good a class of ware as from the older type of down-draft, fired from both sides. In the gas-fired kiln the heat is always travelling in one direction, effecting a saving of 50 to 75 per cent. in burning.

Much more could be said along the line of economy, but if the manufacturer would take the trouble to examine his own plant the value of these hints to him might be realized.

In the effort to secure a smokeless plant, splendid results have been obtained by the use of slack instead of lump coal, and with forced draft on good suction a wonderful improvement will be noted. Instead of firing once an hour, as is the custom with three-quarter lump, two or three small shovels are put on three or four times an hour, which produces more flame with much better combustion and consequently less smoke. When a steam plant is in operation another method has been found to work out well. That is to turn your exhaust, or a portion of it, into your chimney which seems thereby to reduce to a minimum the density of the smoke. In many places the smoke is not a nuisance, but the manufacturer must ever keep in mind the fact that with this great cloud of smoke passing from his plant gold dollars are floating away. Experts tell us that we are now only getting about thirty per cent. of the heat out of our coal and wood, the rest being wasted by poor combustion.

A plant may have a great deal of machinery and still make very little noise if properly set up and kept oiled and in repair. Have you ever noticed that most of the noise is needless and does not produce profits to the owner, in fact quite the reverse? Better work can be accomplished to the music of a piccolo than that of a bass drum, so put in a silencer.

Lessons from the Recent Depression in the Brick Industry

By W. H. Freeborn, Brantford, Ont.

THERE has never been a year in the history of the clay-working industries which opened with brighter prospects for the brick trade than the one which is now drawing to a close. So far as Canada is concerned there are many contributory factors which, taken in conjunction with each other, indicate a season of unusual development. The exceptional prosperity which marked the year 1912, both as regards agriculture and business generally, apparently lent color to the belief that we as a nation were passing through a year of unprecedented activity. Among the factors which contributed to this assumption might be mentioned the financial and commercial activities of the country. An examination of the bank returns gave to the student of public affairs the impression that there was plenty of money in circulation, and that as a result business would equal that of any previous year. Another factor worthy of consideration was the continued advance in the price of lumber owing to the scarcity entailed by reason of the mild winter of 1912-13. The result is that lumber yards are at present depleted to a greater extent than has been the case for years past. This will likely mean heavy buying next winter, so that instead of lumber easing off in price it is more likely to advance. The high price of lumber would appear to have reassured the brick manufacturer with the possibility of a vision of something good for him and his business.

Assuming that we are experiencing a considerable set-back in the brick trade and that the output is not up to former years, the question naturally arises that there must be a cause for so sudden a change. If the opening of the present year were so auspicious and encouraging to us from financial and other view-points, giving us inspiration for doing and expecting greater things, what is it that brought about so sudden a depression in the brick business, such as has been experienced by every brick manufacturer all over the country? Without being pessimistic one is inclined to think that a reaction has set in and whether it be temporary or prolonged is a question beyond one's power of vision to foretell.

First of all, are we producing more building material than this country can continue to absorb, resulting in a reduced demand for material, creating disappointment in the carrying over of heavy stock and of entailing losses to the manufacturer? In some localities this may be apparent, but it cannot with accuracy be applied to the country as a whole. If we admit that the supply of brick is greater than the demand, the question arises whether brick making as a commercial proposition is a safe investment. Being a staple product brick is an absolute necessity. The smallest hamlet and the most prosperous and progressive city demand the product at a reasonable cost; therefore, we unhesitatingly say that brickmaking is a safe investment.

The science of brick-making has of late years been brought to a high standard and with modern machinery, proper locations and adequate facilities for careful production, success would seem to be assured, provided, of course, that the requirements of the public are amply catered for and that brick-making enterprises are conducted on a proper commercial basis. In the opinion of many the present depressed conditions among clay brick manufacturers in our large centres is due in part at least to the fact that large plants are poorly managed and an inferior article is manufactured. Underselling in the market is the inevitable result with its attendant consequences. The inferior product brings a poor price, produces low dividends and at the same time minimizes the efficiency of the plant. At a time such as the present a great deal might be accomplished through judicious advertising. By placing his products before the public through the agency of trade and other journals, the manufacturer often benefits largely as a result. Admitting that a depression exists in the brick industries we can only look forward hopefully to the unborn future and let each man make his business a part of himself, so that when the inevitable boom arrives he will be prepared to meet it both successfully and profitably.

A New Face Brick Plant at Meaford, Ont.

By M. B. Baker, Kingston, Ont.

CLAY products, including bricks, tile, sewer pipe, terra cotta, paving bricks, roofing tile, etc., are made from two raw materials. First we have the unconsolidated true clays, which are formed from rock decomposition, and secondly, clay rocks, which are called shales. True clays are plentiful in the southern states beyond the glacial margin of the recent glacial period in North America. South of this margin, rock decomposition has developed a considerable thickness of its products. These are the only true clays to be found in America. In Canada, however, the recent glaciation ploughed off all such clays, or mixed them up with such a percentage of ground rock that our so-called clays are nothing more than indiscriminate mixtures of clay, sand, rock-flour, gravel, and boulders. True, there are many places where the melted ice supplied water which resorted this material to such an extent that the finer grained material was kept by itself and these are the deposits which are used in Canada in the manufacture of common bricks and drain tile.

All higher grade products, such as pressed brick, terra cotta, sewer pipe, flooring and roofing tile, are made in Canada from shales. These shales are old clay accumulations which resulted from rock decomposition, were carried by streams and deposited in large bodies of water. They are therefore clean, even-grained, continuous, and homogeneous throughout, and were laid in horizontal beds whose thickness and regularity can be relied upon. Since they are the results of rock decomposition the product is a pure clay. They are therefore the highest grade raw materials that we can get for the manufacture of clay products.

In Ontario, only two shales have as yet proved quite satisfactory in manufacture, although many others have been used. These two are known as the Hudson River shale and the Medina shale. They lie together, the Medina being the uppermost bed, and they outcrop in a belt starting between the city of Toronto and the town of Beamsville, and extend in a northwesterly direction towards Georgian Bay. Here they outcrop between the towns of Thornbury and Meaford (see Fig. 1). About the Toronto end a number of brick plants have been established, e.g., Don Valley, Mimico, Port Credit, National Brick Company at Cooksville, Brampton, Milton, as well as glazed sewer pipe plants at Hamilton, Mimico and Swansea. Until this summer there was no plant on the northern end of this belt. All the intermediate portions of the belt are so covered by later rock formations and glacial drifts, that they are hopelessly buried so far as their economic value is concerned.

It has been already stated that the Hudson River shale outcrops between Thornbury and Meaford on the shore of Georgian Bay and it was on this property that the Meaford Brick Company established its face brick plant. The exact location of the deposit is best shown by the accompanying map sketch (Fig. 1.), the shale area being shaded. It covers approximately seven hundred and fifty acres and is one hundred and forty-three feet deep to the level of Georgian Bay, but has been drilled by this company another sixty feet below water level. It extends from the water's edge southward to the Collingwood gravel road as shown on the map. From this point southward it is overlaid by upwards of two hundred and fifty feet of mixed limestones, sandstone, and glacial drift so that it is of no economic importance beyond this road. This is shown by the sketch (Fig. 2) and it will be noted that this gravel road marks the base of this high escarpment which overlies the shale beds. This high escarpment marks the shore line of a pre-historic lake, just as the present shale bank marks the shore of the present Georgian Bay. In Fig. 2 an attempt has been made to show these relationships and it is hoped that this will

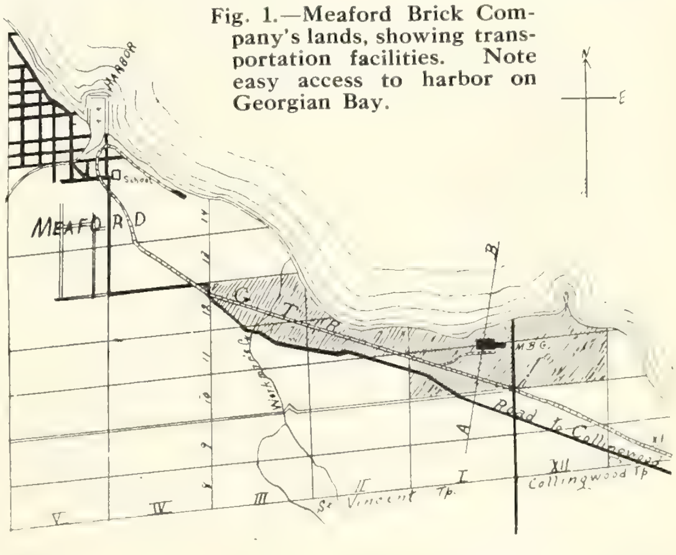


Fig. 1.—Meaford Brick Company's lands, showing transportation facilities. Note easy access to harbor on Georgian Bay.

be understood by the reader. The shale beds are here shown as a bench or shelf extending northward from the high escarpment to and even beneath the present water level. These beds of shale lie almost flat as shown in the sketch. Referring to Fig. 1, it may be stated that at the west end the shale beds were cut off by the stream marked there as Workman's Creek. Formerly this was a large river which cut out a deep broad valley and has, by its wandering where it entered the old lake, cut out a broad fan which extends from approximately its present position all the way westward to Meaford Harbour; so that in this area the shale has been cut out and eroded to the present level of Georgian Bay.

Towards the east, the shales dip or slope and are gradually covered by a deeper and deeper layer of boulders. The writer in his geological travels has never seen an area where boulders have been so abundantly dropped as here. They are actually in almost solid beds so much so that one can step from boulder to boulder. This great accumulation has of course cut off, from an economic standpoint, the use of the shale any farther east than the town line between St. Vincent and Collingwood as shown in Fig. 1. From these descriptions it is seen that the Meaford Brick Company has secured all the economically available shale on the northern end of this belt.

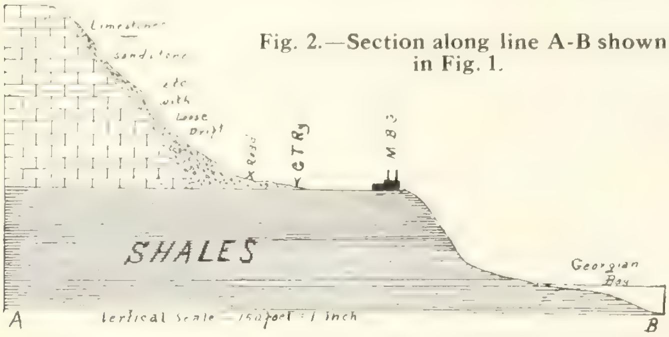


Fig. 2.—Section along line A-B shown in Fig. 1.

Hudson River shale is very much the same thing wherever found and is a remarkably high grade product. Below will be seen a series of analyses taken from various localities using Hudson River shale, and it is striking to note the remarkable similarity in their composition. The first two represent samples taken from the Meaford Brick Company by the writer, and the others as indicated represent samples also taken by the writer in preparing a Government Report for the Bureau of Mines of Ontario in 1906 on "Clay Products of Ontario."

Locality	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Loss by Heat
1 Average Meaford	58.42	16.18	7.41	3.53	3.18	8.88
2. Average Meaford	59.34	17.46	7.86	2.64	2.92	8.48
3. Port Credit	56.46	18.19	7.43	2.56	2.93	8.52
4. Don Valley	57.86	20.00	6.83	2.92	3.25	5.74
5. Mimico	57.12	18.52	7.28	3.92	3.32	6.40
6. Milton	53.20	17.73	6.91	6.00	3.24	9.58

It will be seen at once how remarkably uniform in character, at least from the standpoint of analysis, these Hudson River shales are. But as they were all laid down at one time and in the one body of water, it would be expected that they would be much alike. It is therefore quite to be expected that a company operating on an easily obtainable Hudson River shale would have much the same success in manufacture.

The following will be a brief outline of the process of manufacture as used by the Meaford Brick Company. As shown by Fig. 2 and also in Figs. 3 and 4, these flat-lying shales come right up to the grass roots. Fig. 3 is a reservoir which this company built by damming one of the small gullies near the edge of the bank. This ensures a fresh water supply and shows clearly the flat-lying shales coming right up to the surface of the ground. Fig. 4 is a bird's-eye view of the company's property taken from the top of the high escarpment to the south. It serves to show the absolutely flat shelf-like character of these shales as described in the fore-going part of this article. These shales are ploughed by means of a hard-nosed road plough. The loosened shale is then gathered by wheel scrapers and conveyed to a clay hopper, beneath which a belt conveyor is running. This conveyor carries the shale to a large storage bin which feeds directly into the pan-mills, which grind the shale till it will pass through a ten-mesh screen. The screened product is carried to storage hoppers which feed directly to the dry-press machine, or to the pug mill of the stiff-mud machine, as desired.

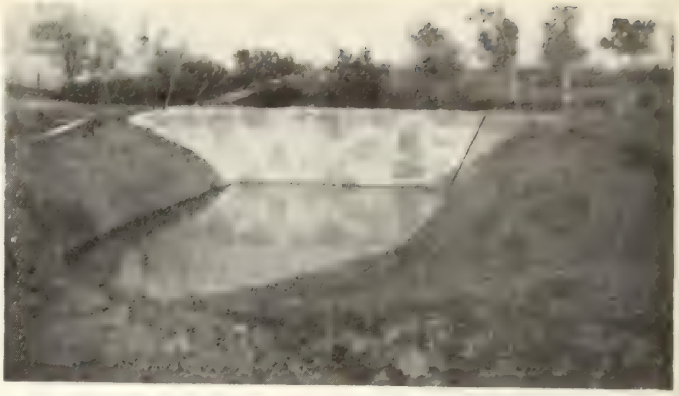


Fig. 3.—Reservoir at the Meaford Brick Company's plant.

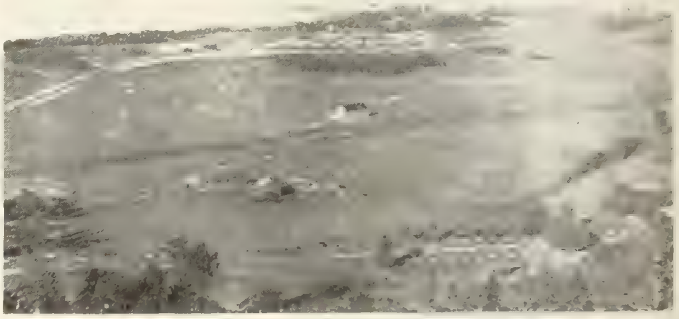


Fig 4.—Bird's-eye view of the property.

In the dry-press process the brick are made on a Berg machine, and are set on steel cars, 500 to a load. This is the first time the shale has been touched by hand. These cars are run on railway tracks directly into the kilns for burning where the bricks are piled ready for burning. This is only the second time, and the last that the bricks are handled till ready for shipment.

In the stiff-mud process the ground shale enters the pug mill of a Freeze machine capable of making eighty thousand bricks per day. Here it is mixed with just enough water to make it a stiff putty, it is then forced through the machine as a solid bar with beautiful smooth faces and sharp corners. This bar is cut by fine wire into bricks, which pass on to an endless belt from which they are lifted by hand and piled on steel cars 500 per load. This is the first time the shale has been touched by hand in this process. These cars are then run into tunnels where they are left to be dried. This drying is done by a current of air made hot by the waste heat from the burned kilns and drawn through the tunnels by a large fan. When the bricks are thoroughly dry, which requires from 30 to 40 hours, the cars are run as before into the kilns where the bricks are lifted off to be set ready for burning. This again is only the second time and the last that the material has been touched by hand since being ploughed in the pit.

The burning of both the stiff-mud products and the dry-press products takes place in down-draft kilns which are shown in Fig. 5. The principle of these kilns is that the fire is built in separate pockets, passes up through fire-brick flues to the dome of the kiln, here it bends over and passes down through the loosely set brick, out through a perforated floor into flues which lead to the large chimneys. There are three kilns to each stack. When the bricks are burned they are all red in color and are loaded directly into freight cars, or onto stock piles for later shipment. The company has a siding from the Grand Trunk Railway. This is built in a shallow cut, as shown in Fig. 5, so that the floor of the car comes on a level with the yard thus facilitating the loading very materially.

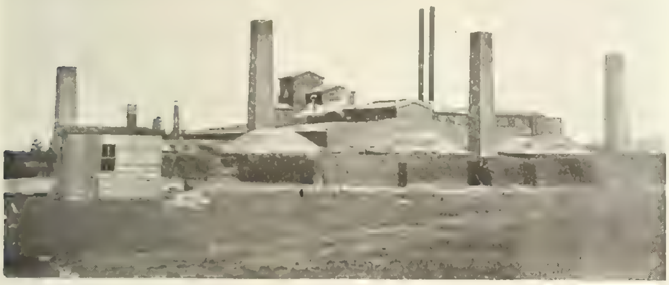


Fig. 5.—Down-draft kilns at Meaford Brick Company's plant.

The Meaford Brick Company has so far confined its operations to brick making, but with such an unlimited supply of high grade shale it should have no difficulty in adding from time to time the manufacture of any of the other structural materials. There is little doubt that tile for roofing and floor, hollow-block for the inside walls of buildings, paving bricks, sewer pipe and terra cotta will be added in the course of time.

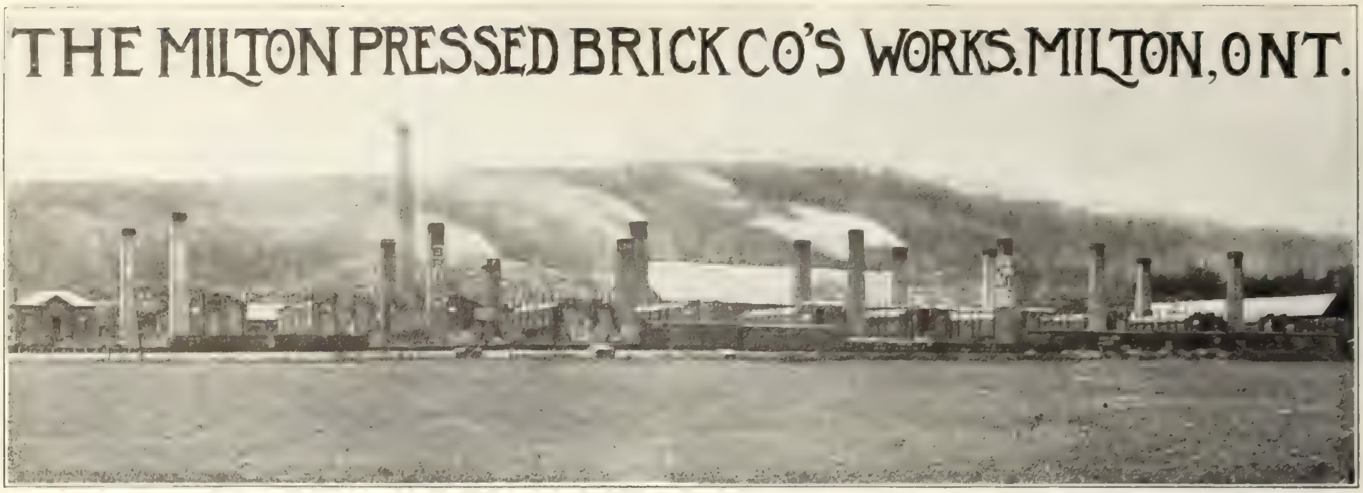
New Brick and Tile Plant at Brantford

THE remarkable industrial activity of the city of Brantford has received a fresh impetus in the building and equipment of the new plant owned and operated by the Ideal Brick and Tile Company, Limited. This plant is situated to the east of the city, and the fact of its being located on a bank of serviceable red clay goes to emphasize its value as a commercial asset of the company, seeing that the outlay which haulage of the raw material would entail under other circumstances is here avoided. The plant is thoroughly equipped with soft-mud and drain-tile machinery, and as an example of the economical methods in use at this factory it is sufficient to state that the exhaust of the steam power is used in drying the product. This process is effected in a Bechtel drier. By its means the brick are thoroughly dried without checking or cracking, and the full capacity of the firm's Martin A machine is satisfactorily handled. The plant, which has been running throughout the season, is turning out the very finest grade of soft-mud brick and drain tile; indeed it is not too much to say that the grade of the material produced is the best that can be manufactured by this process.

The Bechtel truck system is in extensive use in the brick yards. By this system the company's material is handled with remarkable ease, while at the same time the finished product is left in excellent condition. The firm has been doing exceedingly well up to the present. With the object of adding to the productive capacity of the plant the owners have in contemplation the provision of four round down-draft kilns. All of which goes to show that the expansion stage has already been entered upon, and that a period of successful development is already in progress.

Every kiln should have a pyrometer and recording draft gauges. They determine the best draft at each stage of the burning and enable the burner to maintain this draft. The pyrometer keeps the burner wide awake and alert and shows quickly any change in the kiln temperature. Their use saves loss of fuel and damage to ware.

Ideal Brick and Tile Company's plant at Brantford, Ont.



Making Pressed Brick at Milton, Ont.

THE Milton Pressed Brick Company's plant is one of the most successful in the country. The plant, which is conveniently situated just outside the town of Milton, Ont., has been in operation for about twenty-four years. The firm has been under the same management ever since it was first organized, Mr. J. S. McCannell, the president and manager, having been associated with the company since its formation.

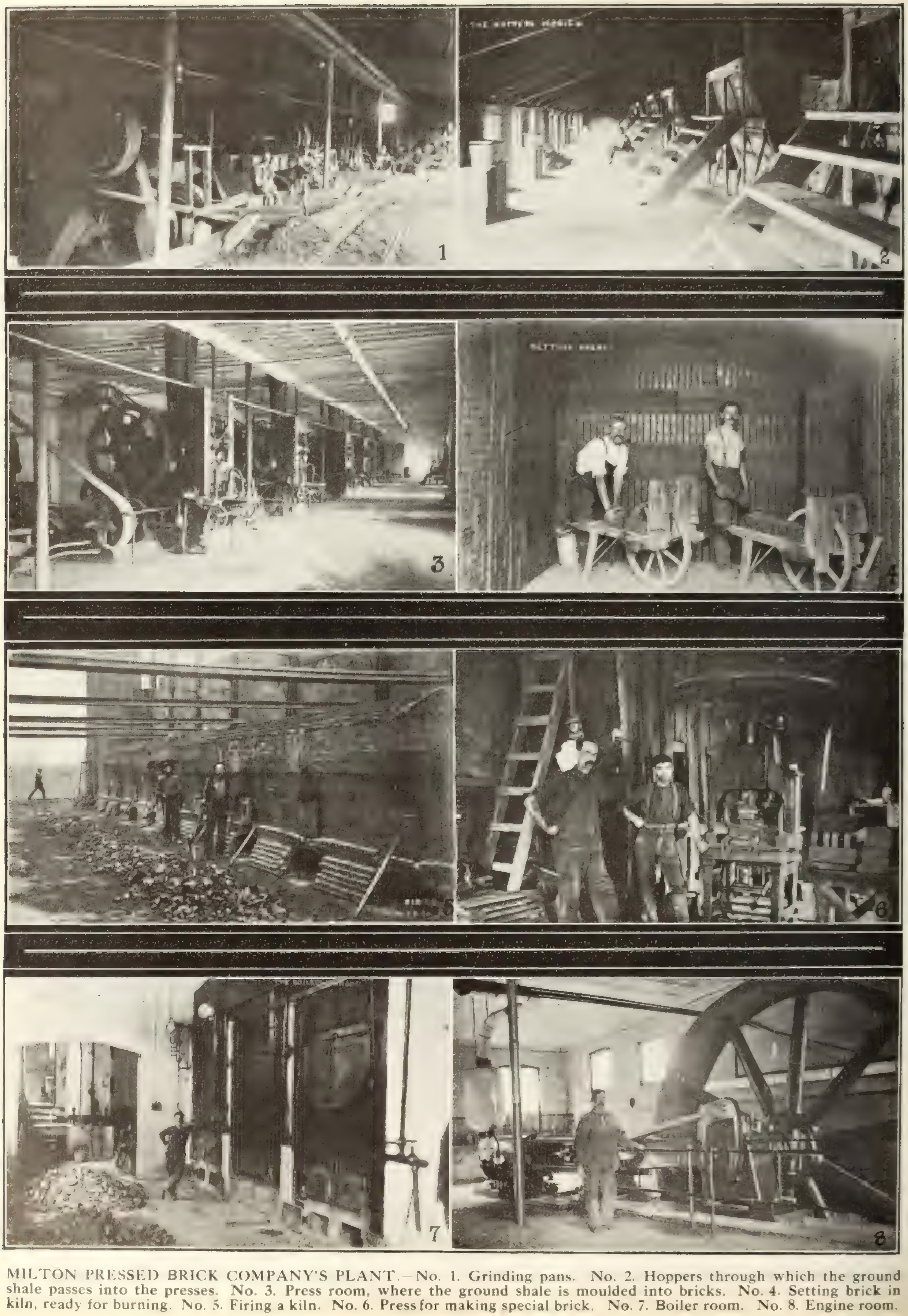
The plant has a capacity of 125,000 face brick a day, a fact illustrative of the enterprise which characterizes the company in meeting the increasing demand for Milton brick. Red and buff dry pressed bricks are manufactured, as well as several varieties of fireflash effects in both red and buff colors. The company own 300 acres at Milton and are very fortunate in the clay they possess there. The pit runs in strata of red and buff colors, and is pure shale with practically no impurities of any sort. This shale is of the Medina formation and has been tested to a depth of 400 feet. The shale is worked from the bank with a fifty-foot face and runs in colors of red and buff alternately. It is blasted out with dynamite and hauled in cars to dry pans. The material is then ground, being tempered to a slight dampness just sufficient to allow it through the screens, which reduces it to the fineness of powder. In producing other shades of brick by flashing in the burning, the Milton company claim to be the pioneers.

The press room contains eight Boyd presses and extensions are being made to admit three more of the same make. Each press has a capacity of 18,000 to 20,000 brick a ten-hour day. The great advantage in having all the machines from one factory can be readily understood when it is considered that the stocking of spare parts which will fit lal the machines minimises

Mr. J. S. McCannell, President and Manager of the Milton Pressed Brick Company.

Show room in the Toronto office of the Milton Pressed Brick Company. The walls of this room consist of eleven solid brick panels, each panel representing a different grade of brick.

MILTON PRESSED BRICK COMPANY'S PLANT. - No. 1. Drilling, preparing for blasting. No. 2. Blasting the shale. No. 3. Shale beds No. 4. Hauling shale to grinding pans No. 5. Shale beds. No. 6. Grinding pan. No. 7. Bird's-eye view of plant and farm.



MILTON PRESSED BRICK COMPANY'S PLANT.—No. 1. Grinding pans. No. 2. Hoppers through which the ground shale passes into the presses. No. 3. Press room, where the ground shale is moulded into bricks. No. 4. Setting brick in kiln, ready for burning. No. 5. Firing a kiln. No. 6. Press for making special brick. No. 7. Boiler room. No. 8. Engine room.

as far as possible the time lost in effecting repairs. The press room is 200 feet long.

There are at present fifteen kilns in operation, each having a capacity of 200,000 brick. Of these kilns thirteen are down-draught and the other two up-draught. The company are building several more down-draught kilns. The engine room contains a 360 h.p. Wheelock engine, which provides the power required, while there are three boilers of 90 h.p. each used for steam purposes. The water required for the plant is obtained by gravity from a reservoir.

The shipping facilities which the company possess are excellent. They have a C. P. R. siding at the plant which will hold 25 cars, and they have also first-class arrangements for switching on to the Grand Trunk Railway, which is situated within a convenient distance of the factory yards. It is interesting to mention that there are 25 men employed continuously in the work of loading brick for shipping.

The various processes of brick-making naturally entail a good deal of labor and at present about 150 men are employed, of whom a number, like Mr. McCannell, have been connected with the company since they started.

The plant has been running winter and summer for many years, and the company are looking forward to next year as one of the best in the history of brick production at Milton.

A Successful Sand-Lime Brick Plant at Brantford

At the present time when the productive capacity of brick-making plants is increasing in every direction, it is gratifying to find that the industries of Ontario are keeping abreast of the times in supplying an ever-increasing demand for all kinds of brick manufactured in the Dominion. One of the most modern plants to be found in Canada to-day is the sand-lime brick factory at Brantford, Ont., owned and operated by the Schultz Brothers Company, Limited. This plant, which was among the first of its kind to be located in Canada was installed in 1907. It has a capacity of 20,000 bricks a day, and so rapid has been the firm's progress that despite the present temporary dullness in the market their plant is working at maximum capacity, a fact which in itself testifies to the quality of the brick turned out.

In the Berg system, which is the one adopted at this plant, the steps in the process are four in number, consisting of the slaking of the lime, the mixing of the lime and sand, the pressing into moulds, and the baking or curing. In the process of slaking only sufficient water is added to the lime to bring about the hydration. Two kinds of sand are used, soft or fine, and coarse. The company have a considerable area of land right in the immediate vicinity of the plant, and from this pit the coarse sand is taken, while the soft sand is obtained at a second pit a short distance away, being conveyed to the factory by teams. Before the mixing of the sand and lime takes place, the lime requires to be slaked. The lime used at the plant is strong magnesia lime, about six cars of which (22 boxes to the car) are used per day in the process of brick-making. After being watered to some extent before it is put into the cylinder, the lime is slaked by a mechanical process under a steam pressure of 100 lbs. to the square inch. The slaking goes on through the night, which is generally found to be the most convenient time, and the lime is ready to undergo the mixing process next morning. Prior to this the lime is fed through a grinder to pulverise it, this process rendering it as fine as powder before reaching the sand. The mixing machine consists of a steam jacketed drum with interior rotary blades operated by suitable gearing outside and at one end. This drum is filled by means of a funnel at the top. When the drum is charged, the interior mixing blades are set in motion and the contents are heated by means of the steam jacket surrounding the drum. A vacuum pump attached to the apparatus removes the steam and air from the drum. When the sand has been properly dried the required quantity of finely pulverized lime is introduced into the drum through a special aperture and the mixture is again stirred and heated. After wetting by the addition of the necessary quantity of moisture the mixture is given sufficient time to allow a preliminary combination of the sand and lime to take place and produce a mixture of sufficient tenacity to allow of easy molding. In the preparation of the sand, great care must be exercised. It is first put through a steam dryer and from there it is conveyed to a bin capable of containing a full day's output of the finished product. After it leaves the bin in which it is sifted and mixed the sand is taken on to the measuring machine. The chemical action set up by the presence of silica in the sand and magnesia in the lime effects the required chemical combination. After being measured and mixed to the required consistency by single shaft mixers it is then conveyed by means of an elevator to the first floor where it undergoes further treatment before introduction to the press. This operation is continuous and automatic from first to last. The firm use a four-mold improved Berg press, the capacity of which, as already stated, is 20,000 bricks a day. After emerging from the press the molded bricks are piled on open cars. These cars when filled are run into the steaming cylinder. This latter is large enough to accommodate the maximum day's output of the plant, being 6 ft. x 80 ft. long. The cylinder having been filled it is closed and sealed, and steam under a pressure of 120 lbs. per square inch is applied. The period of baking occupies about twelve hours to perform. It is the usual practice at this plant to operate the press during the day and to steam the day's run through the night.

This process completes the manufacture of the bricks, which are then taken out and piled into the stock sheds in the yards ready for shipment. Every facility is at the firm's disposal for rapid loading of the finished product, there being sidings of the Grand Trunk Railway and the Canadian Pacific Railway alongside the yard. Although the company specialize in making the natural color sand-lime brick they also turn out red and buff brick that have become popular of late. A feature of the plant is that the same process serves for all three varieties, the only variation in manufacture being with regard to the coloring which is done at the time the sand and lime are being run through the measuring machines.

The Berg make of machinery is in use throughout the factory, steam power being supplied by a 75 h.p. Goldie & McCulloch engine. The high pressure boiler was installed by the John Inglis Company, Limited, Toronto.

A new record was established at the Herscher, Ill., plant of the Illinois Brick Company when, one day early in September, it made 300,000 brick in eight hours. This is the largest number ever turned out in one day at this plant, the former record being 298,000. The brick were handled by seventeen men, or an average of 19,650 per man in eight hours, or forty-one brick per minute.

General view of York Sandstone Brick Company's plant, showing transportation facilities.

The Manufacture of Sand-Lime Brick

Last Word in Methods and Equipment at the New Plant of the York Sandstone Brick Company, Limited

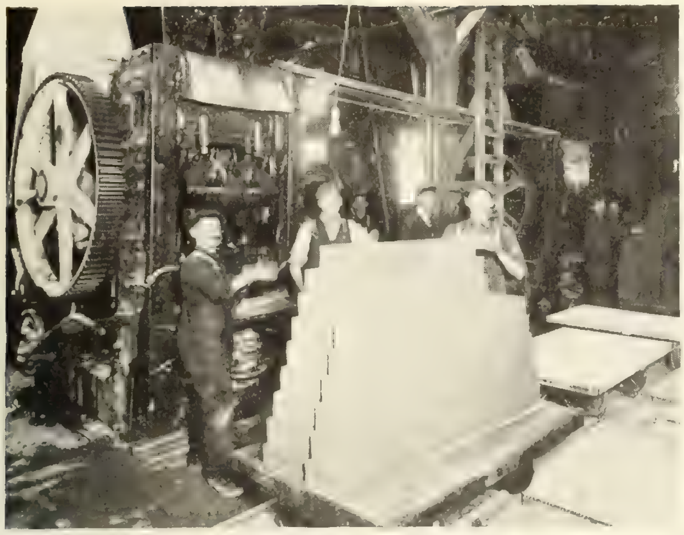
THAT sand-lime brick as a modern clay product is gaining in popularity every day would seem to be established by the increasing number of plants erected exclusively for that particular process of manufacture. One of the most up-to-date plants and the first of its kind to be located in Toronto is that of the York Sandstone Brick Company, Limited, which is conveniently situated in East Toronto, near York Station on the Grand Trunk Railway, at the corner of Gerrard Street. As recently as March, 1913, the ground was broken for the erection of a forty thousand capacity plant for the manufacture of sand-lime brick. Substantial buildings of brick and concrete and a large sand drying shed of one thousand tons capacity were erected, the construction work being completed in July.

The company has a capital of $80,000, of which $55,000 is preferred and $25,000 common stock, all fully paid up. The board of directors of the company is as follows:—Mr. Alex. McCurdy, president; Messrs. Douglas Ross, Walter Page and D. L. Tarleton, and T. J. Smyth, managing director, who is also president of the York Sand & Gravel Company, Limited, with whom the York Sandstone Brick Company have entered into a twenty-five-year agreement for its supply of sand in the manufacture of sand-lime brick. Mr. Smyth is also a member of the well-known builders supply firm of Smyth & Ryan. Having had such a wide experience in the various processes of brick manufacture, and of builders' requirements generally, he is eminently fitted for his managerial position in the York Sandstone Brick Company and it is not surprising to find that he experiences little difficulty in maintaining the full running capacity of the plant. The importance of sand-lime brick as a factor in the market of today is evidenced in the success which has attended this project.

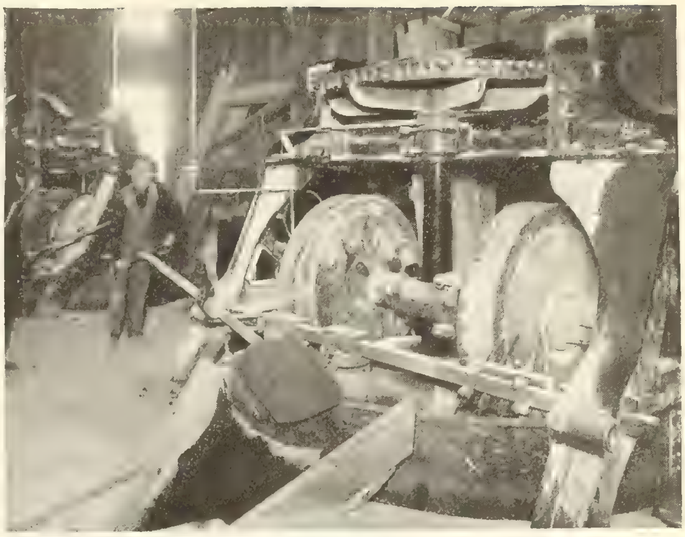
The process of manufacture is interesting. The sand which is sharp, free from loam and other impurities, is conveyed from the pits by a radial inclined belt-conveyor to the top of the sand shed, where it passes over a coarse screen to remove the large stones and gravel. It is then conveyed by gravity down a radial chute to any part of the shed desired. This shed, which has a capacity of one thousand tons, is divided into sections enabling the sand to be used from one end while the other is being filled and dried. The excess moisture having been eliminated from the sand it is fed through a slot in the floor of the shed onto a belt conveyor located in a tunnel under the floor. It is then carried to the elevator which raises it to the top of the shed and deposits it on screens. Passing over these it is caught at the bottom on another belt conveyor and carried to the sand hopper, from which point it is fed into wet pans by a measuring device fed by gravity.

The process of dealing with the lime and reducing it from its raw state is equally interesting. First of all the lime is unloaded from cars at the door of the lime room. Passing through a jaw crusher it is elevated to the hydrating room. Here water is added to slack the lime and it is then fed into silos from which point it is transferred into the wet pans as required. This system of handling the lime is known as the Pre-Hydrating system and so far as the York Sandstone Brick Company is concerned it has proved very satisfactory. Having now been properly mixed and ground in exact proportions the lime and sand from the wet pans is passed into the presses and subjected to a pressure of 25,000 pounds a square inch. The brick are then taken from the presses and loaded on Berg sand-lime brick cars which are run into the hardening cylinders. These cylinders are hermetically sealed and the brick are then subjected to a further steam pressure of 125 pounds a square inch. This process takes approximately ten hours. The cylinders are then opened and cooled and the brick, being finished, are now ready for shipment. In this respect the company's own siding on the G. T. R. offers every facility for the rapid loading and shipping of the finished product.

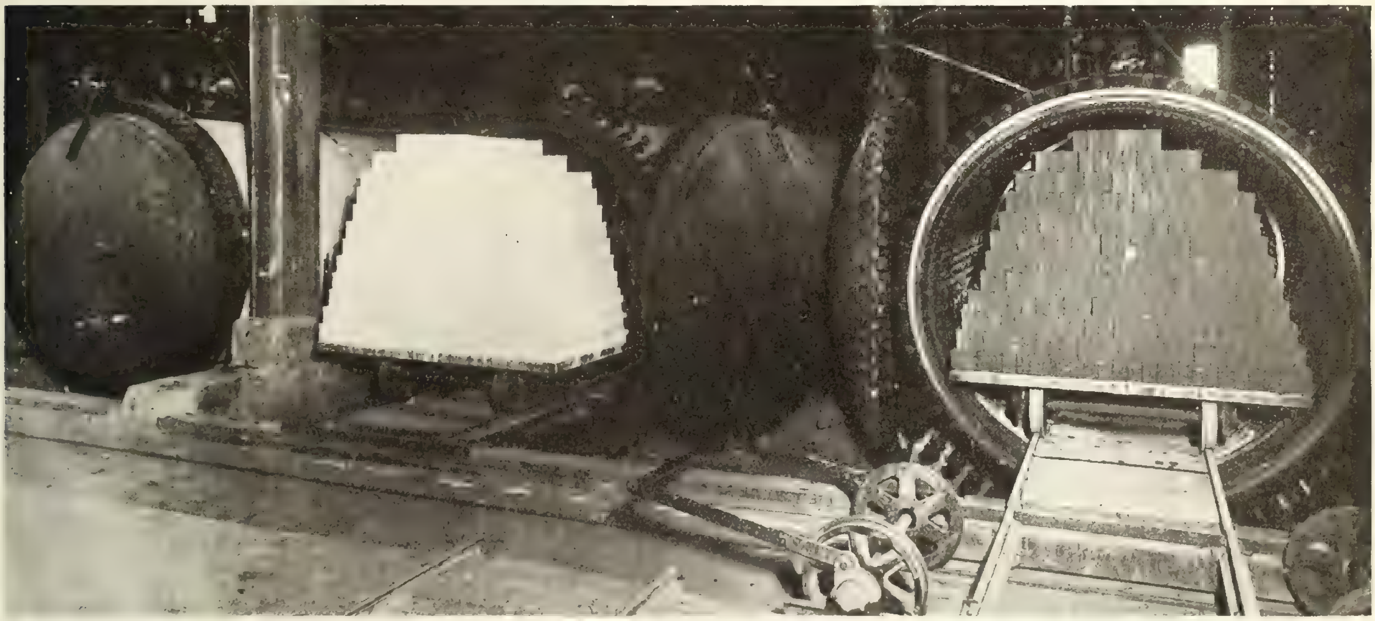
Accessibility to the works is an important point and in this the company is well served by a good wagon



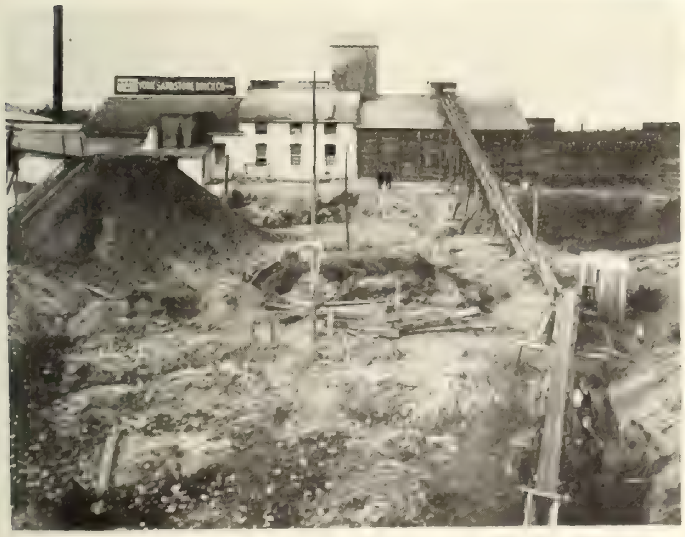
Berg press in operation. Capacity 22,000 daily.



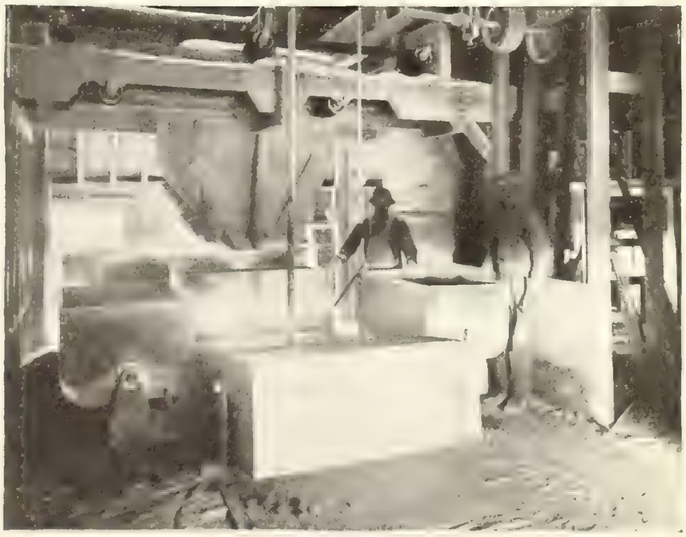
Heavy duty wet pan.



Hardening cylinders.



View of plant showing belt conveyor.



Hydrating room.

The York Sandstone Brick Company's Plant

road which leads into the yards from either Gerrard Street or Danforth Avenue.

As regards machinery, the York plant is one of the best equipped in the Dominion, none but the latest types of equipment being installed. The machinery consists of two Berg King B presses, two heavy duty Berg wet pans, three hardening cylinders, and as already stated, eighty Berg sand-lime brick cars. A Berg high pressure boiler, capable of developing 150 h.p., is also installed. Motor power is supplied by a Westinghouse motor, 150 h.p., driven by hydro-electric power, also a 25 h.p. motor which is used to drive the lime hydrating equipment and sand conveyor system.

The brick made by the York Sandstone Brick Company, Limited, is the only product in Toronto which has a frog or stock mark, a point which invariably meets with the approval of every builder. A few of the points of superiority which the company claims for this brick are: uniformity in color, size and quality (it being uniform with standard stock and facing brick) freedom from culls and bats, the portion of broken brick being extremely small. As an evidence of their staying qualities the sand-lime brick manufactured by this company have passed a crushing test at the School of Practical Science, of 99,600 pounds per whole brick or 3,030 pounds per square inch, this test having been made on a brick only one week old. Another feature is the absorption test, which runs from eight to twelve per cent. of moisture, whereas clay brick is said to run as high as thirty-five per cent. While iron melts at about nineteen hundred degrees of heat it is estimated that sand-lime brick will require some three thousand degrees Fahr. A building of sand-lime brick is declared to be drier than one built of clay brick, so that the greater freedom from dampness renders the sand-lime brick building warmer in winter and healthier all the year round. Because of this freedom from excessive moisture such a building is less liable to crack in frost.

Among the local job contracts in which the York Sand-Lime Brick have been used recently are, Shea's New Hippodrome, Terauley Street; Picture Theatre, Queen Street West; factory on Dundas Street; warehouse on River Street; church on Spadina Avenue. In addition to heavy deliveries by teams, from two to three cars have been shipped daily during the last month. Sand-lime brick manufactured by this company are sold at $7.00 a thousand, f.o.b. car at the plant. The company's offices are at 123 Bay Street, Toronto.

Brick Paving Construction at Welland, Ont.

By D. T. Black, Town Engineer

UNTIL recently Welland was content with macadam pavements, but the heavy increase in traffic due to its rapid growth, the introduction of a street railway system and the many openings in the macadam surface for water mains and sewers, made its streets almost impassable. The Council of 1912 commenced their first permanent street pavement improvements when a contract for brick on 5-inch concrete base was awarded in March to Mr. C. H. Kaumeier, Port Huron, Mich., for 40,000 square yards, to cover the three main streets—known as East, West and South Main Streets. Each street has a single street railway track and terminates at one of the three railway stations, the total length being nearly two miles. The original tender called for pavements 32 feet, 35 feet and 45 feet in width, but these were changed later to 35 feet, 40 feet and 45 feet. The contract price was $109,892.50, but before the contract was commenced the base was changed to 6-inch concrete and with other minor alterations the estimated cost was increased to $118,912.52. The amended price per square yard was $2.47 and on track allowance $3.39. Both prices included all grading to thickness of pavement. The work was commenced in May, 1912, but owing to bad weather and other conditions only one-third of the total contract was completed last year. Operations were resumed this spring and completed successfully this fall.

Brick pavement under construction at Welland.

The work proceeded in the order of rough grading, curbs, fine grading, concrete base and brickwork. The sub-grade was rolled with a 12-ton steam roller. Previous to rough grading the catchbasins (street gutters) were placed by town employees. The catchbasins consisted of concrete pipe (24-inch diam.) with special castings cast in a local foundry. The curbs were all of concrete made in lengths of 5 ft. 6 in., 1 ft. 6 ins. in depth, and 6 in. in thickness. The core was composed of one part cement, two parts sand and four parts gravel and a wearing surface one inch thick of one part cement to two parts sand. Under the curbs a trench one foot in depth was cut. This contained tile drain (4-inch diam.) with the remaining part of the trench filled with gravel. Most of the curbs at street crossing corners have radii of ten feet. The few exceptions where the streets did not meet at right angles have radii varying from 8 feet to 40 feet. The amended specifications called for a concrete base of six inches of concrete, having aggregates of one part cement to seven parts Lake Erie sand and gravel mixed (sand not to exceed 50 per cent.). This base was laid in a fairly wet condition, straightened off with template and tamped. The sand cushion was $1\frac{1}{2}$ inches in depth when loose. The bricks used on this contract were all Metropolitan Block and were carefully culled before and after rolling. The bricks were rolled with a 5-ton horse roller until a smooth surface was obtained. Provision for expansion was made with a 1-inch asphalt joint along each curb. The filler used was cement grout of sand and cement in equal parts, applied in two or three coats with a brush and squeegee.

After the final application of the filler, the pavement was kept closed to traffic from seven to fourteen days. The street railway tracks consisted of 6-inch T-rails, weighing 60 pounds a yard, spiked to cedar ties and oak ties under joints. The depth of concrete below the base of rail was one foot, composed of the same aggregates as the 6-inch concrete base. This allows of 6 inches of concrete below ties and 6 inches between ties. The ties, with rails spiked, were blocked up to grade in advance of the concrete mixer, thus allowing the construction of the track concrete and side base at the same time. The space between the rails and that outside, making the track allowance 8 feet 3 inches in width, was also paved with Metropolitan Blocks.

During construction a change was made in the track allowance outside of the rails. At first three courses of stretcher bricks were laid parallel with the rail, but the vibration of the cars showed signs of destroying the grout joints. The stretcher courses were then eliminated and the header course continued from curb to rail. So far this has proved more successful. In all cases the outside brick was kept from ¼ inch to ⅜ inch below the top of the rail.

The Catherine Street pavement was awarded to Mr. C. H. Kaumeier at prices much similar to those of his other contract, the same specifications being used. The pavement was 24 feet in width, and totalled some 900 square yards. Bessemer Blocks were used instead of Metropolitan.

It may be of interest to state that during the present year 1.8 miles of sewers have been constructed. All of these have been of single and double strength vitrified sewer pipe and varied in diameter from 8 inches to 20 inches. The depths were from 8 feet to 17 ft. 6 ins. The manholes were all constructed of concrete, with straight walls 9 ins. in thickness, the aggregates being one part cement to six parts Lake Erie sand and gravel. The total cost of the entire works was $20,051.59.

Completed brick-paved thoroughfare at Welland, Ont.

New St. Paul's Church, Toronto

THE new St. Paul's Anglican church on east Bloor Street, Toronto, which has just been opened, presents features of absorbing interest, particularly to the building trade. A detailed article illustrative of the design and construction of the new edifice appeared in The Contract Record and Engineering Review as recently as June 4, 1913, therefore reference to a few of the main features will suffice here. Architecturally the style of the new building follows the early English and the decorative periods of Gothic. The lines on both the interior and exterior and ornamental detail have been carried out with due regard to the magnitude of the church, so that the impression obtained is that the building represents the harmonious adaptation of Gothic architecture to a special problem in planning design. The whole exterior of the church is of stone with stone trimmings, while the interior has been designed after the cathedral style. The exterior dimensions are, length 220 ft.; width 140 ft.; height 97 ft.; interior length of nave, 152 ft.; width of nave and aisles, 75 ft.; width of nave, aisles and side aisles, 105 ft.; width of transepts 130 ft.; height of apex of roof, 91 ft. The floor is of composition stone flags, and the aisle between the pews of composition red tiles. The choir is paved with white, green and pink marble tiles, and the steps leading to the choir and communion table are of white marble. The roof is of open timber work with Gothic tracery. The architect was Mr. E. J. Lennox, 164 Bay Street, Toronto, who has achieved noteworthy success in the designing and completion of the church, which involved an outlay of about $350,000.

There is real economy in the storage shed or bin, aside from the solution of the wet clay problem. Repairs or accidents may cause you to shut down the augur, but the grinding machine is still delivering its regular supply. Should the grinding machine get out of order, the brick machine is not handicapped, for the bin holds a surplus.

The Frontenac Floor and Wall Tile Company's Plant.

New Clay Industry at Kingston

WITH the starting of the plant of the Frontenac Floor & Wall Tile Company, Limited, in Kingston, Ont., this month to manufacture floor, wall and decorative tile, the Canadian trade, which has hitherto depended on the English and American market for these goods can be supplied with the Canadian-made article. That there is a growing demand for ceramics, art mosaics, encaustic, wall and decorative tile, is evidenced by the fact that last year 5,000,000 feet, valued at over half a million dollars, was imported into the country.

The company started building operations in August and the plant was completed by November 1st, Wm. McCartney & Sons, of Kingston, being the contractors. The factory is of brick and steel construction, 96 x 270, one storey, with two large kiln buildings connected and has a floor space of 24,000 sq. ft. The plant is within sixty miles of the largest and finest felspar and silica mines in American and both felspar and silica comprise over 50 per cent. of the proportion of raw material used to produce tile. The balance of the raw material, which is china clay, is imported from England. The shipping facilities are excellent, the company having both the G. T. R. and the C. P. R. right at their door as well as being able to ship by water. Electric power is used throughout.

The factory is equipped with modern clayworking machinery supplied by the Patterson Foundry & Machine Company, of East Liverpool, Ohio, the Model Machine Works, of Trenton, N.J., and the kilns by John Lovitt, of Trenton, N.J. It will have a capacity of one million square feet of tile per annum. About eighty hands will be employed at the outset.

In the process of manufacture of this tile, the crude clay is put in the blungers where it is mixed with water before passing through sieves composed of phospor bronze fire of 120 strands to the square inch. These sieves eliminate all sand and foreign matter from the clay. The liquid clay then passes through electric magnets which eliminate any particles of free iron which may exist in the clay. Less than one-quarter per cent. of this free iron in the clay would cause a defect in the finished product. The liquid clay then passes to the settling tanks from which it is pumped into filter presses. These filter presses are so constructed as to hold minute particles of clay, the excess water filtering through pressed chambers. The clay being taken from the filter presses contains about 30 per cent. of moisture. It is then dried on steam coils and passed through crushers and pulverizers. These pulverizers run at high speed and reduce the clay into dust which passes through a 16-mesh screen to eliminate coarse particles. The dust is then taken to the presses which are so constructed with a hammered steel screw working in phosphorus bronze nuts as to obtain a pressure of eight tons to the square inch, pressing various sizes and designs, which are formed by the chilled steel dies. The tile are then in compressed dust form and are put in fire clay boxes which are placed in patent up and down draft kilns. The reason the tile is encased in fire clay boxes is to keep the direct fire from flashing the ware. The firing of the tile is continued for about 96 hours and is brought up to a finishing point by about 1400 degrees centigrade. It then requires about 72 hours cooling. The tile are then drawn from the kiln and are sized, shaded and assembled in the different patterns and designs.

The Frontenac Floor & Wall Tile Company, Limited, is a purely Canadian company, with a capitalization of $250,000, practically all of which is Kingston money.

Extensive Operations of the Nova Scotia Clay Works, Ltd.

THE Nova Scotia Clay Works, Limited, with head office at Halifax, N.S., incorporated February 29, 1912, has just completed its construction work started some two years ago. At the time the company was formed it had only one modern, up-to-date plant, situated at Pugwash, N.S. The company's market covers a wide area, including Newfoundland, Cape Breton, Prince Edward Island, and all the Northumberland Strait, ports in Nova Scotia and New Brunswick, as well as having rail connections as far as Campbellton, Fredericton, St. John and Halifax. It was recognized that to take proper care of the brick and clay manufacturing business, it would be necessary to establish modern plants equipped with the most up-to-date machinery at various points in their territory, so the firm decided to establish three additional large plants at Pugwash, N.S.

The next plant to be built was at Annapolis Royal, N.S., situated on the Annapolis River, and commanding all the Minas Basin, Bay of Fundy, the Western Nova Scotia ports, as well as being provided with rail connections throughout the entire Annapolis Valley. This plant is particularly well situated to cater to the St. John, New Brunswick trade, being only a matter of five or six hours sail. The third plant has been established at Lantz Siding, near Elmsdale, a point on the Intercolonial Railway, about 36 miles from Halifax. Though it has no water connections it is well provided with shipping facilities by rail into Halifax, and also to all points served by the Intercolonial Railway throughout Nova Scotia and New Brunswick.

It is expected that owing to the great development work the Government has in contemplation for the port of Halifax, a considerable demand will be created for the products of the company. The Elmsdale plant, in addition to manufacturing ordinary stock brick, will also produce hollow terra cotta blocks, farm tile, pressed brick and sewer pipe, for shipping throughout the entire Maritime Provinces.

With the advent of modern fireproof buildings there is a growing demand for fire-proofing materials, such as hollow clay blocks, and this branch of the clay manufacturing business is proposed to be taken care of in a thoroughly up-to-date manner. All kinds of fire-proofing will be manufactured in the various sizes and it is expected that this department of the business will show increasing expansion as time goes on.

The company has provided for the growing demand for drain tile by installing an up-to-date tile manufacturing plant at the Elmsdale works. It is evident, judging from the encouragement the various Governments are giving the farmers, that scientific farming, which includes under-draining, will shortly be taken up on a large scale by the farmers of the Maritime Provinces, and as this development will include the use of drain tiles the firm has made ample provision to meet any demand that may arise.

All the company's plants are equipped with down-draft, continuous burning kilns, the latest type of machinery, steam shovels and cranes for handling the clay, sand and brick, and every known appliance that will produce a better class of clay product.

The combined plants will have an output of 30,000,000 brick a working season, which is more than at present consumed in the Maritime Provinces. Having an eye to the future, however, and believing that the Maritime Provinces are only beginning to come into prominence, the management has undertaken to provide so that when the demand arises the company's plants will be in a position to meet it.

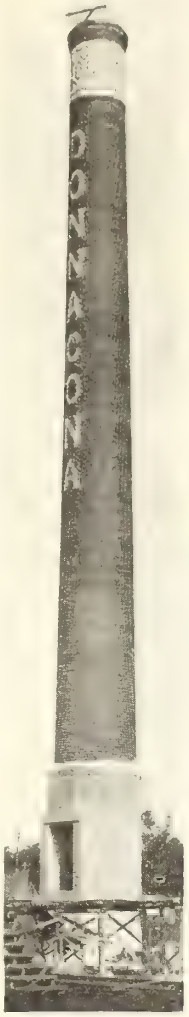
The products of the firm are said to compare favorably with those manufactured by any other plant throughout Canada or the United States. The clay is thoroughly ground and mixed and is burned in the kiln at an even temperature resulting in the maximum quantity of hard brick and the minimum quantity of soft. At present the kilns are producing brick approximately 95 per cent. hard, which is a very high percentage compared with the product turned out by the old scoved, up-draft kilns which have been in vogue in Nova Scotia and Eastern Canada for so many years past.

In addition to its other properties the company has a shale deposit at its Pugwash works which has remained undeveloped so far. This shale has been tested by expert clay-working engineers and has been pronounced the best that has come to their notice, either in the United States or Canada. Samples of paving brick have stood tests unequalled by any other paving block manufactured on the North American continent. It is the intention of the company to commence the manufacture of paving blocks at an early date.

Having gone through two years of construction work the firm is now in a position to handle any trade that may offer from its territory. Judging by the high quality of its products and its determination to set a high standard, the future of this enterprising company would appear to be assured.

Excellent business is reported by the Silicate Brick Company of Ottawa for 1913, both in output and sales. Over six million brick have already been disposed of this year and another two million are sold for winter delivery. The firm state that they have furnished brick for every large building in the Capital this year and that Ottawa has never experienced a better year for large office and warehouse buildings.

Large Radial Brick Chimney in Quebec



Radial brick chimney at Donnacona, P.Q.

The Alphons Custodis Chimney Construction Company, of New York, has recently completed a large radial brick chimney for the Donnacona Paper Company, Limited, of Donnacona, P.Q. The chimney is among the largest in Canada, it being 175 feet high and nine feet inside diameter at the top. The massive foundation is of concrete, eight feet thick and twenty-five feet wide, reinforced with steel rods. The lower thirty feet of the chimney proper is octagonal in shape, built of red brick, giving the structure a pedestal effect. Surmounting this is the round Custodis radial brick column, deep cherry-red in color. Having been worked out to a very graceful design the taper is most pleasing. At the top will be noticed a decorative effect of lace-like pattern. This has been accomplished by building the upper fifteen feet with buff-colored radial brick, interspersed with deep red brick, forming the pattern. The extreme top is covered with a cast iron cap. The name "Donnacona" has been built into the red column with buff-colored radial bricks. Each letter is six feet high, the whole sign being over eighty feet long. The contrast between the deep red column and the light buff letters causes the latter to stand out very prominently, so that the sign can be read for a great distance. The construction of the column is similar to that which the Custodis chimney company have employed in some two hundred radial brick chimneys they have built in Canada, and similar to that which was used in building the tallest and largest chimney in the world, 506 feet high and 50 feet inside diameter at the top, for the Boston & Montana Consolidated Copper & Silver Mining Company, at Great Falls, Montana. The stupendous size of this chimney can be imagined when we realize that were the Washington monument placed within the chimney, a double team of horses could be driven between the outer walls of the monument and the interior of the chimney, the Washington monument being but fifty feet wide at the base, as compared with a width of seventy-six feet of the chimney at the same point. By reason of the unusual size, weighing over seventeen thousand tons, and the difficulties attending the scaffolding and handling of materials at such great heights, it is asserted that the building of this radial brick chimney at Great Falls, Montana, was the finest engineering achievement in chimney building ever accomplished. The special feature in the construction of these chimneys is that they are built of perforated radial brick, cut on a radius to fit the diameter of the chimney as the diameter varies in the height. The blocks being perforated vertically to their beds, the mortar in the horizontal joints enters the blocks from three-quarters of an inch to an inch, keying one to the other, as it were, with a mortise and tenon joint. The perforations allow a more thorough and homegeneous burn of the block, on account of which they have greater crushing strength than if the blocks were solid. The perforations form also an insulating air blanket around the chimney, having the effect of cutting down materially the radiation and producing a more even temperature with a steadier draft. Another quality claimed for the perforations is that not only do they strengthen the stack but lighten it also, thus making for smaller and less expensive foundations. The blocks are also acid-proof, and when used with a specially prepared mortar, produce an acid-proof chimney, many of which have been built in Canada and the United States for smelters, chemical plants, paint works, and other manufacturing plants where acid fumes are produced. When it is remembered that these fumes are destructive of steel, concrete, or ordinary brick, it will be conceded that the introduction of this acid-proof chimney is a welcome innovation in view of the expense often occasioned by renewals and repairs.

Dean Galbraith's Jubilee

Engineers from all parts of the North American continent gathered in the engineering building of the University of Toronto on the evening of December 5 to pay tribute to the worth and work of Dr. John Galbraith, Dean of the Faculty of Applied Science, on the happy occasion of the fiftieth anniversary of his entrance as a freshman and the thirty-fifth anniversary of his founding of the School of Practical Science. The function was the twenty-fifth annual dinner of the University of Toronto Engineering Society, and those present included eminent engineers and public men, leading educationists and a large muster of undergraduates, close on six hundred guests in all being present. The gathering was presided over by Mr. F. C. Mechin, president of the Engineering Society. The toasts were:—"Canada," proposed by Mr. G. M. Smythe and responded to by Col. W. N. Ponton, Belleville; "The Dean," proposed by Mr. Hyndman Irwin; "University of Toronto," proposed by Mr. W. E. Phillips, responded to by President R. A. Falconer, University of Toronto; and "The Profession," proposed by Mr. O. G. Lye, responded to by Mr. R. A. Ross, C.E., Montreal, and Mr. H. F. Ballintyne, of New York.

Dr. John Galbraith.

Reference was made during the evening to the eminent position which Canada occupies today in the engineering world and the enormous influences exercised over the profession by the Engineering Faculty of the University of Toronto. The dominant feeling of the gathering was one of profound veneration for the guest of the evening, and the fact that so many prominent engineers had come from points so far apart as Montreal and Pittsburg to honor him was a tribute which falls to the lot of few men to receive.

Among the guests present were:— President R. A. Falconer, University of Toronto; Mr. F. C. Mechin, President of the Engineering Society; Col. W. N. Ponton, Belleville; Sir Edmund Walker, President of the Bank of Commerce, Toronto; Mr. T. W. Gibson, Deputy Minister of Mines; Dr. R. A. Pyne, Minister of Education; Mr. Thos. Galbraith, brother of Dean Galbraith; Professors C. H. C. Wright, Peter Gillespie, R. W. Angus, A. H. Laing, and T. R. Rosebrough; Mr. J. S. Dobie, President of The Ontario Land Surveyors' Association; Mr. Willett G. Miller, Provincial Mineralogist; Mr. R. A. Ross, Montreal; Mr. J. L. Morris, Pembroke (who was the first graduate of the School of Science); Mr. H. F. Ballintyne, New York; Mr. M. Bowman and Mr. D. A. Ludgate, of Pittsburg; Mr. J. W. Tyrrell, geologist; Mr. H. B. Stuart, Hamilton; Mr. C. H. Marrs, Hamilton; Mr. E. H. Downer, Hamilton; Mr. W. J. Francis, C.E., Montreal; Mr. G. H. Duggan, chief engineer Quebec Bridge; Mr. D. C Tennant, Montreal; Mr. J. A. DeCew, Mr. J. H. Challis and Mr. C. S. Pinhey, of Ottawa; Mr. H. J. Bowman, Berlin; Mr. Eric Armour, K.C., Toronto; Mr. Chas. H. Mitchell. Toronto; Mr. J. G. Clark, Toronto; Dr. Bruce Macdonald, Toronto; Mr. Z. A. Lash, K.C., Toronto; Mr. David Mollitor, C.E., Toronto; Dr. W. H. Ellis; and the following past-presidents of the Engineering Society:—Mr. T. Kinnard Thompson, New York; Professor H. E. T. Haultain and Mr. T. R. Loudon, Toronto; Mr. E. A. James, Toronto; Mr. R. J. Marshall; Mr. W. B. McPherson; Mr. R. E. Ritchie; Mr. T. H. Hogg, etc., etc. Letters expressing regret at their inability to be present were received from:—Sir George W. Ross, Toronto; Mr. Frank B. Gilbreth, C.E., New York; Sir Edmund Osler, Toronto; Sir John Gibson; Sir J. P. Whitney; Sir Wm. R. Meredith; Mr. J. W. Flavelle; Dr. J. A. MacDonald; Mr. J. Butler, C.E., Montreal; Mr. T. R. Deacon, C.E., Mayor of Winnipeg (who was to have responded to the toast of "The Profession"); Major R. W. Leonard, etc.

Having received his early education in Port Hope, John Galbraith entered the University of Toronto in 1863, graduating with a gold medal in mathematics and being Prince's prizeman in addition. For ten years succeeding his graduation he followed the profession of civil engineer and was identified with the construction of the Intercolonial, Midland and Northern railways. In 1878 he was given the chair of civil engineering on the founding of the School of Practical Science in Toronto, and today he is still the leading spirit in the councils of the Faculty of Applied Science, which is the successor of the School of Practical Science under the University Act of 1906. The steady growth of the Faculty since its inception is in itself a high tribute to the genius and personality of Dean Galbraith and today a large body of engineers in Canada and other countries look back with the warmest affection and the highest appreciation to the man who, above all others, showed them how to do things.

The sentiment of the evening was neatly expressed by Mr. Hyndman Irwin in his toast to Dr. Galbraith:."We enter the University as students to find him the Dean of Engineering in the University; we leave as engineers to find him the Dean of Engineering in Canada."

Contracts have been awarded for the construction of the last sixty-mile stretch of the Kettle Valley line and for the substructure of the 1,000-ft. bridge over the Fraser River at Hope. Steel has been laid for more than one hundred miles and two hundred more have been graded.

Personal Mention

Mr. R. B. Smith has been appointed Secretary-Treasurer of the Stinson-Reeb Builders' Supply Company, Eastern Townships Bank, Montreal.

Mr. E. B. Bonnell, city clerk of Moose Jaw is receiving applications for the position of city engineer. Applicants are required to state experience, references and salary desired.

Mr. Leonard W. Rundlett, City Commissioner of Moose Jaw, Sask., has resigned and will close his connection with the office on January 1.

Mr. James Clifford, formerly district engineer of the Illinois Central Railroad at Chicago, has resigned and been appointed assistant engineer, maintenance of way, C. P. R. western lines, with office at Winnipeg.

Mr. George Janin, Chief Engineer of the City of Montreal, has applied to the Controllers for permission to retire on a pension of three-quarters of his salary. The Controllers refused the application, however, on the ground that it would create a precedent. Mr. Janin is entitled to half his salary on retirement.

Mr. A. H. Harkness, B.A.Sc., consulting engineer, Toronto, was the lecturer at a well-attended meeting of the Engineering Society of the University of Toronto on Wednesday, November 26th. His subject was "The Construction of Modern Skeleton Frame buildings." The lecture was illustrated with lantern views.

Mr. S. W. Black, president and general manager of the Black Building Supply Company, Limited, Toronto, sailed on the 15th ult. for Europe and will make an extended tour of about six months' duration. During his absence the business will be under the capable direction of Mr. N. W. Drummond, secretary-treasurer of the company.

Mr. P. H. Moore, lately mining engineer and manager for the Canadian Allis-Chalmers Limited (mining, crushing and cement machinery department), has accepted the position of general manager of Rock & Power Machinery, Limited, with head office at Toronto and branch offices in Halifax, Montreal, Sudbury, Cobalt, Winnipeg, Calgary and Vancouver.

Mr. George T. Clark, city engineer of Saskatoon, Sask., has resigned after a service of five years. A graduate of the University of Toronto, with honors in mathematics and civil engineering, Mr. Clark commenced his professional career on the construction of the Temiskaming and Northern Ontario Railway. For a time he was employed in the roadway department at Toronto, following which he was resident engineer for three years with Messrs. Galt & Smith on water and sewerage works.

We have received from the Herbert Morris Crane & Hoist Company, Limited, Peter street, Toronto, a number of interesting pamphlets regarding some of the features of their plant, of which Mr. Malcolm R. Meldrum is director and general manager. To mention but a few of the numerous lines to which reference is made there are particularly good illustrations of the Morris triple-gear chain blocks, hand overhead travelling crane, travelling worm-gear chain block and the Morris Q. E. F. runway. The reputation which the Morris company have achieved for all-round excellence and reliability is proverbial not alone in Toronto but also in many parts of the Dominion where their peculiarly adaptable makes of chain blocks and travelling cranes are so well and favorably known. The company make a practice of shipping all blocks on the same day as that on which the order is received, so that there is no delay or loss caused by unnecessary waiting.

Mainly Constructional

The News in Brief—From Coast to Coast

The Pedlar People, Limited, Toronto branch, have removed from their old premises at 113 Bay Street to the new building at the corner of College and Markham streets.

City Engineer Craig is preparing an extensive report on the paving operations that have been conducted in Calgary during the past year, both by the municipal plants and repairs by private companies.

Foley Brothers, Stewart and Faquier have been awarded the contract for the second section of the Intercolonial terminal scheme, Halifax, the price being $5,208,743. The contract let is for the dockage facilities and wharves at the port following the letting some time ago of the first section of the work, which provides for a new entrance of the railway into Quebec.

The Dominion Government has voted $350,000 towards the construction of the Second Narrows bridge, which the Burrard Inlet Tunnel & Bridge Company have invited the Provincial Government to take over.

Good progress is being made in the construction of the line along the north shore of Burrard Inlet, and it is anticipated that a regular passenger service will be inaugurated on January 1 from Dundarave to North Vancouver.

A Building Owners and Managers' Association has recently been formed in Winnipeg with the object of enabling owners and managers of large buildings to get into closer communication with each other for mutual protection and benefit.

Mr. H. D. Chamberlain and Mr. R. H. Somers, of Chamberlain, S.D., are about to establish a large brickmaking plant at Fort George, B.C., which is located about 450 miles north of Vancouver and midway between Prince Rupert and Edmonton railroads.

One of the oldest contractors in Montreal has passed away in the person of Mr. Joseph Bronsdon, aged 93. He was interested in many of the early big contracting works in the district, notably the Government building on St. Helen's Island, the St. Eustache bridge, and the Lachine Canal.

Work has been commenced on a big drainage system for the north-western section of Victoria, B.C. The sewer will run from Burnside Road along the ravine and beneath the concrete bridge on the Gorge road to the shore of the Arm. Along this same route will be located the line of the C. N. P. Railway.

The new brick works recently completed at Elmsdale are said to be among the largest and best equipped of any in the provinces east of Montreal. The Nova Scotia Clay Works, Limited, are the owners, Mr. John R. McLeod is the president, and Mr. R. C. McDonald, vice-president and general manager.

The general annual meeting of the Povince of Quebec Association of Architects will be held in the association rooms, City Hall, Quebec, January 17th. The examinations for the admission to the study of architecture or registrations will be held on the 26th January, and on the following days, in the rooms of the association, 5 Beaver Hall Square, Montreal, at nine o'clock in the forenoon, each day.

Mr. Griffiths, Engineer of Public Works, who recently investigated the Second Narrows bridge project at Vancouver, has made his report which is now in the hands of Premier McBride. Mr. Griffiths was instructed to go into the question of cost and ascertain if it would not be possible to build a bridge across the Second Narrows at an expenditure much less than the $2,250,000 quoted in the estimates of the inter-municipal company.

The Pacific Great Eastern Railway intend establishing extensive yards and terminal facilities at Newport at the head of Owen Sound. The scheme will include the taking over of the two Indian reserves there for terminal and townsite purposes. The reserves contain about 1,100 acres and considerable water frontage, where wharves are to be built. The line along the north shore will be used largely for passenger traffic and Newport will be the sole shipping point.

The Ottawa Corporation by-law to provide for the construction of the new $8,000,000 waterworks has been quashed by Mr. Justice Lennox on the ground that according to the powers conferred by the Provincial Legislature the vote of the people must first be obtained. The Judge said that were the by-law allowed to stand the property of every landowner in the city would be mortgaged for a sum equal to the present debenture of the city.

A new hotel scheme for Kingston, Ont., has been adopted by the Board of Trade. Mr. Geo. F. Balfour, of Montreal, who is the prime promoter, has secured an option on the British-American hotel property, on which site he proposes erecting a $200,000 fireproof house, up-to-date in every particular. The intention is to provide one hundred and twenty-five rooms with rotunda, grill, dining and ball rooms. The equipment and furnishings are to cost about $60,000.

Upwards of twelve million dollars will have been spent upon the Hudson Bay Railway scheme by the end of 1915. So far, including office expenses, nearly $4,400,000 has been expended and the three contracts for the railway proper aggregate $8,577,000, to which must be added administrative expenses. The harbor and terminal expenditure will be some millions. There is much dredging to be done, and in addition docks, terminals, ice-protection piers and similar works must be executed. The end of the railway leading from Port Nelson may be commenced next spring and the scheme should be completed some time in 1915.

Speaking before the Canadian Club, Montreal, Mr. F. H. Wentworth, Secretary of the National Fire Protection Association, condemned many of the present buildings as fire traps. Ordinary brick and stone buildings were valueless as fire stops, because the windows were of thin glass and the window frames of wood. "We must," said Mr. Wentworth, "come eventually to the equipment of all commercial, factory and office buildings with metal window frames and wired glass. This will mean the abolition of the conflagration hazard in our cities." He also condemned the use of shingles, as they ignited easily and caused flying sparks. The height of buildings should be limited.

The Court of Appeals, Montreal, has reversed a decision of Mr. Justice Archibald in the case of C. G. Wills & Company, contractors, England, vs. the Central Railway Company of Canada. The parties could not agree over the construction of the line from Midland, Ont., to near Montreal, the contractors claiming that certain amounts were due under the contract. The company, on the other hand, claimed that the contractors had not fulfilled their obligations. Mr. Justice Archibald gave judgment for the contractors, restraining the company from giving out the work to another firm or doing it themselves. The Court of Appeals found that $2,373 is due to the contractors, but quashed the injunction and terminated the contract.

Among several railway projects to engage the attention of parliament next session is that of the Canadian Alberta Company, who will apply for incorporation with power to construct a line of railway commencing at a point on the C. P. R., one mile west of Blairmore, thence in a northerly and westerly direction. The Calgary and Edmonton Railway Company will apply for an act authorizing the construction of a line from a point on the north and south branches of Sheep Creek, Alta., also a line to a point on Trap Creek. The C. P. R. will also apply for an act authorizing the construction of lines from a point on its Swift Current south-easterly branch, and the Esquimalt and Nanaimo railway will seek an act extending the period for the construction of its authorized lines.

From a report issued by Mr. S. H. Jarrett, Building Inspector, Vancouver, we learn that the permits issued for November, 1913, totalled 101, of the value of $300,565, as against 186 of the value of $1,538,795 for the same period in 1912. The total number of permits for the eleven months of this year were 1929, of the value of $10,248,803, as compared with 3035 permits of $17,898,067 value for the same period in the previous year. This serves as a pretty reliable index to the trade conditions in Vancouver this year. The building operations for the past month, together with their money value, consisted of 57 dwelling houses, cost $42,585; four apartment and rooming houses, cost $226,000; five factories and warehouses, cost $9,600; twenty-nine offices and stores, cost $21,770; repairs and alterations six, cost $610.

British Enterprise in Canada

The well-known English firm of Sutcliffe, Speakman & Company, Limited, of Leigh, Lancashire, Eng., have decided to open a branch house in Canada with staff and stores suited to the requirements of their Canadian trade. The managing director of the firm, Mr. E. R. Sutcliffe, has just completed a visit to this country and we understand that he has been favorably impressed with the prospects which the future offers. The company specialize in brick-making machinery, one of their specialties, the Emperor Press, having gained a very wide reputation as being in the forefront of modern machinery for the manufacture of sand-lime brick. This press has been installed by the government of New South Wales for their extensive plant at Sydney, with results which are eminently satisfactory to the makers. The Emperor Press is made in three sizes, the Single, with an output of 15,000 bricks a day, the Duplex, with an output of 26,000 bricks a day, and the No. 0 size, with a capacity of 10,000 bricks a day. Mr. Sutcliffe is convinced that in the near future sand-lime brick will be in great demand in Canada, particularly in Western Canada, an element in their favor being that the Emperor Press can be installed at less cost than clay plants.

Another specialty of the firm is their press for the manufacture of pressed plastic brick. It is plain that this press will make brick in the plastic state quite stiff and dry enough to go directly from the kiln to the machine without the need of drying sheds. In other words it gives the same quality brick as produced by the stiff mud system with all the advantages of the dry press system in addition. This plastic press, in Mr. Sutcliffe's opinion, will exercise an important influence on the future of the shale brick-making industry in the Dominion.

The automatic bottom dump car manufactured by Messrs. Bechtels, Limited, Waterloo, Ont., embraces in its design and construction a number of points worthy of investigation. It is built for exacting conditions and hard work and is recommended on the ground of its durability and simplicity. This firm make a scoop dump car which is particularly easy to operate, and also an automatic grip for all cars, to be used with a continuous running cable which enables the car to be stopped at any point without the attention of the operator. Winding drums and portable track are also manufactured by the company.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Ont.

Extension of intake pipe is contemplated by Town Council. Mayor, Mr. Mulligan. Town Engineer, Mr. Leblanc.

Leamington, Ont.

Town Council contemplate drain repairs. Clerk, R. M. Selkirk.

Pavements and sidewalks are contemplated by Town Council. Clerk, R. M. Selkirk.

Additional water mains on Fox St., Georgia Ave. and Morgan Ave. are contemplated by Town Council. Clerk, R. M. Selkirk.

Ottawa, Ont.

Paving planned by Board of Control. Mayor, J. A. Ellis. City Engineer, Arch. Currie, City Hall. Report being submitted to Board of Control re cost of placing all streets in city in good condition. Estimates completed.

Chlorination buildings, $5,214, planned by City Council. City Engineer, Arch. Currie, C.E. Excavating.

Tilbury, Ont.

Council contemplates extending present water mains 6,000 ft. Clerk, W. A. Hutton.

Toronto, Ont.

Paving materials required by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 16th. Specifications, etc., at Room 12, Purchasing Dept. Annual supplies:—1. Asphalt (refined); 2. Vitrified paving blocks; 3. Granite or stone sets; 4. Treated wood blocks; 6. House numbers.

Repairing, Dawes Rd., cost $6,000, contemplated by York Twp. Council. Clerk, W. A. Clark, Jarvis and King. Work is requested by deputation of property owners. Grading and resurfacing with double macadam.

Waterproofing subways for C. P. Rly. Co. Engr. Grade Separation, B. Ripley, 262 Avenue Rd. Plans, etc., at office of Engineer will will receive tenders until noon Dec. 27th. for labor and material in connection with waterproofing of eight subways. Grade Separation.

Tenders received until Dec. 16th for laying and jointing 36-in. water main from High Level Station to West Toronto in 3 separate contracts. Tenders also received for laying 20 in. main. Plans at Works Dept., Room 9, City Hall. Board of Control. Mayor, H. C. Hocken.

Pavements recommended by Board of Control. Commr. of Works, R. C. Harris. Bitulithic on Lamb Ave, 18 ft., $14,521; Keele St., 24 ft., $24,219; asphalt on Bloor from Sherbourne to Avenue Rd., $32,138; brick block on Overend, $6,292; Front, $13,165; Tate, $4,226. Approved by Committee of Works.

Walks on 13 streets, estimated cost $24,000, recommended by Board of Control. Mayor, H. C. Hocken. Approved by Committee of Works. Commr. of Works, R. C. Harris.

Pavements recommended by Board of Control. Commr. of Works, R. C. Harris. Asphalt on Winchester, Boler and Leslie, estimated cost $10,712; 2 lanes, estimated cost $5,587. Approved by Committee of Works.

Board of Control, Mayor, H. C. Hocken. Tenders received until Dec. 16th for grading on Braemore Gardens, Hiawatha and McGregor ave. Plans at office of Commissioner of Works.

Rocmac pavement contemplated by York Twp. Council. Clerk, W. A. Clarke, 40 Jarvis. Engineer, F. Barber, 57 Adelaide E. Ratepayers in Burton have petitioned for pavement. Referred to Engineer.

Sewer contemplated by York Township Council. Clerk, W. A. Clarke, 40 Jarvis street. Council passed by-law to construct 775 ft. of sewer on Kennedy ave. north of city limits and 357 ft. on Barrie ave., 12-in. and 15-in. sewer pipe to be used.

Sewers planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 16th for sewers on Annette, Blackburn, Clifford, Danforth, Gerrard, Norway Place, Oriole Parkway, Orchard Park Blvd., Waverley Rd., Wharram, Woodbine and Moore Park Drainage System, Western Section No. 1, Moore Park Drainage System, Western Section No. 2. Plans at City Hall.

Vancouver, B.C.

City Council have decided on paving South Cambie, Victoria Drive, Commercial Drive, Helmcken, Drake, Alexander, Cordova, Cornwall and Vine St. and 11th Ave., cost $311,776.36. Engineer, F. L. Fellowes.

Paving, cost $171,500, is contemplated by City Council. Engineer, F. L. Fellowes. Cypress St., Prince Edward St. and Venables St., Campbell, Ave., Fir St., 13th Ave. and 11th Ave. Materials, asphalt, granitoid, asphaltic and brick, wood block.

South Vancouver, B.C.

Box drains on Gladstone St. and via 54th and 56th Sts. to Victoria Drive, cost $4,317, recommended by Municipal Council. Clerk, Mr. Springford, Fraser and Wilson Rd. Engineer, Mr. Clement.

Winnipeg, Man.

Watermains planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contractor, J. W. Astley, Engineer of Construction, City Yards. Watermains in Blake street, $118.40; Grey street, $135; Winnipeg ave., $220.80 and St. James St., $67.50.

Tenders received by Board until Dec. 15th for 200 manhole frames, 250 manhole grates, 220 mud baskets, 650 manhole brakes, 500 catch basin hoods, 500 catch basin hinges and pins, 1,000 long steps, 3,000 short steps. Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

East Princeton, B.C.

Waterworks system planned by Town Council. General contractors, The British Columbia Portland Cement Co., Ltd., 615 Hastings St. W., Vancouver. Sec.-treas., A. R. Briggs. Materials for dam—pipes, hydrants, etc., required.

Ottawa, Ont.

Chlorination building (Lemieux Island), cost $5,213.54, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Plumbing and heating, M. M. O'Connel, 212 Gloucester, $932.54. Mason, carpentry, electric wiring, motor and mixer, Alexander & Campbell, 587 Lisgar St., $4,282.

50 hydrants, cost $5,000, required by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractors, McDougal's Ltd., 529 Sussex St.

Railroads, Bridges and Wharves

Bracebridge, Ont.

Extension to wharf and sheds planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, Jas. Roddick, 40 Wellesley St., Toronto.

Cap Chat, Que.

Extension to pier planned by Dominion Govt., Dept. of Public Works. Secretary R. C. Desrochers, Ottawa. Tenders received but no contracts awarded. New tenders will probably be called.

Capreol, Ont.

Station, cost $5,000, National Transcontinental Railway, Ottawa. General contractor, J. A. King, Capreol. 1½ stys., concrete foundation, frame and brick facing construction, shingle roofing, electric lighting, stove heating, maple floors, plumbing, stucco plastering, plate glass, grilles, blackboards, vaults, safes, screens, fire extinguishers. Foundations partly in.

Charlottetown, P.E.I.

Dredging required by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders received by secretary until Dec. 23rd. Plans, etc., at Dept., Ottawa. Dredges and tugs not registered in Canada shall not be employed.

Kamloops, B.C.

The city will ask government to dredge whole of the "Riverside" waterfront and erect piling and sheeting for a wharf, city to build the deck and make other improvements.

Little Dipper Harbor, N.B.

Breakwater planned by Dom. Govt., Department of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Maritime Dredging & Construction Company, St. John.

Ottawa, Ont.
Steel bridge (Pretoria Ave.). New plans are being prepared by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E.

Pontoon bridge, temporary, cost $6,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. To be erected instead of temporary wooden bridge. Plans in progress.

Bridge, cost $50,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Contractors are invited to inspect details and visit site. Tenders will be called in about a week or two. Steel bridge with walks cantilevered out, concrete abutments and piers. Plans drawn.

Port McNicoll, Ont.
C. P. R. contemplate erecting Section House. Gen. Supt., Mr. Arundel, Toronto.

Poupore, Que.
Training pier and revetment wall planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. No action taken on new tenders.

Sandhead, B.C.
Dredging, cost $70,500, required by Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Navigation Dredging Co., Ltd., Vancouver. Dredging 300,000 cu. yds. sand at mouth of Fraser River.

Sarnia Twp., Ont.
Reeve, Mr. Alf. Hellier, Sarnia. Specifications, etc., with Reeve, who will receive tenders until Dec. 15th for dredging Cow Creek Drain.

Summerland, B.C.
Wharf, cost $12,265, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor. Andrew McConnell.

Sydney, N.S.
Dom. Govt., Dept. of Railways and Canals. Secretary, L. K. Jones, Ottawa. Resolution to be drawn and presented to the government urging need of terminals. Committee appointed by Board of Trade to interview City Council and prepare resolution. Messrs. P. D. Macneil, G. Fitzgerald, F. G. Konig, R. R. Chappell and Capt. A. J. Morrison.

Toronto, Ont.
Steel conduit, cost $540,000 (Island). Board of Control. General contractors, Roger Miller & Sons, Lumsden Building, wishes prices f.o.b. Toronto, on 3,500 ft. of 84-in. steel pipe ½-in. thick, cast steel, flange at each end, 4 only 72-in. gate valves. Above is for steel conduit across Toronto Island.

Victoria, B.C.
Public building and wharf. Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston, Ottawa. Building two storeys and tower, fireproof construction. Plans prepared.

Willon, Man.
Location of C. P. R. station at Willon at mileage 26.5 on Virden-McAuley branch, has been approved.

CONTRACTS AWARDED

Victoria, B.C.
Dump scow, cost $8,475, required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Wallace Shipyard, Ltd., 1165 Davie St., Vancouver. To be used in connection with harbor improvements. Capacity 260 cubic yards.

Welsh Cove, N.B.
Breakwater, cost $11,825 (Mace's Bay), planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Maritime Dredging & Constr. Co., St. John, N.B.

Public Buildings, Churches, Schools, etc.

Berlin, Ont.
Two schools are contemplated by Public School Board who will purchase two sites next year.

Chatham, N.B.
Sunday School building, cost $10,000, for Methodist Trustees. Pastor, R. G. Fulton. Architect, F. Neil Brodie, 42 Princess St., St. John. Work done by day labor. Roofed.

Coaticook, Que.
Post office fittings required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until Dec. 15th. Specifications, etc., at office of R. L. Deschamps Post Office, Montreal, Caretaker, Public Building, Coaticook, and at Dept., Ottawa.

East London, Ont.
Market building contemplated by City Council. Mayor, C. M. R. Graham. City Engineer, W. N. Ashplant, who has been instructed to prepare estimates of cost of erecting market building. If satisfactory by-law will be submitted to ratepayers.

Fort William, Ont.
City Council (Property Committee) recommend addition to City Hall, cost $10,000. Clerk, A. McNaughton.

Hamilton, Ont.
Hospital, cost $40,000, planned by City Council. Mayor, Jno. Allan. Architect, H. New Spectator Bldg. Plastering, furniture, fixtures, etc., required shortly. No tenders called yet.

Hawkshaw, N.B.
Church for Baptist Congregation. Pastor, Rev. A. A. Rutledge. Work will not start until next spring.

Montreal, Que.
Club house contemplated by Y. M. C. A., 127 Drummond St. Site has been purchased and building will probably be put up in spring.

Congregation of Notre Dame, Montreal, contemplate building a new church (St. Famille St.). Parish has purchased site.

Maissonneuve Presbyterian Congregation contemplate erecting a new church. Pastor, Rev. Dr. Scrimger, Adam St., Maisonneuve.

New Waterford, N.S.
Meeting of ratepayers to be called for the purpose of discussing the question of borrowing the sum of $12,000 to be used for erection of school building.

Ottawa, Ont.
Church, cost $6,000, for St. Peters Evangelical Lutheran Church. Pastor, Mr. Clemens, 250 Lyon St. Architect, Herbert Shleacow, Room 45, Sparks Chambers. Walls up.

Tenders to be called for main (high) chimney for Printing Bureau. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa.

New barns at Experimental Farm contemplated by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Will be rebuilt by day labor under direction of manager.

St. Gabriel de Brandon, Que.
Public building planned for Dom. Govt. Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Burnet & Alcide Leclaire, Lachine, Que.

Sussex, N.B.
Drill hall planned by Dom. Government, Dept. of Militia & Defence. Deputy Minister, Eugene Fiset, Ottawa. Tenders received by Director of Contracts, Ottawa, until noon, Dec. 22nd. Plans, etc., at offices of Officer Commanding 6th Div. Halifax, N.S.; Town Clerk. Sussex and Director General of Engr. Services, Headquarters, Ottawa. 106 x 72.

Toronto, Ont.
Sunday school, cost $55,000, for Walmer Rd. Baptist Church. Chairman Com., R. C. Dancy, 153 Spadina Road. Carpenter, Jos. McKenzie, 359 Yonge St. Painting, F. G. Roberts & Co., 104 Wells St. Trimming interior.

School (Howard), planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Dec. 12th, for heating. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School at Parkdale planned by Board of Education. Secretary, W. C. Wilkinson. Heating and ventilating, Callis, Sheppard & Abbott, 279 Brunswick ave., $945.00. Plumbing, Toronto Furnace & Crematory Co., 11½ King St. E., $220.00.

School on George Street, planned by Board of Education. Secretary, W. C. Wilkinson. Hot water heating, Lewis Legrow, 92 Harbor street, $408. Plumbing, Fiddes & Hogarth, King St. West, $159.00.

Victoria, B.C.
School, cost $44,200, Quadra St. N. Board, Secretary, W. T. C. Pope, 112 Catherine St., has decided to throw out all tenders submitted and return cheques on account of lack of funds.

Westboro, Ont.
School contemplated by Westboro Public School Board. Trustee, Mr. Cole.

CONTRACTS AWARDED

Orillia, Ont.
Addition and alterations to post office and customs house, cost $31,485, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, C. Webb & Son, Orillia.

St. John, N.B.
Post office, cost $500,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Rhodes, Curry Co., Amherst, N.S. Ventilators, Jno. E. Wilson, Ltd., Sydney St., St. John, N.B.

Three Rivers, Que.
School, cost $65,940, planned by City Council. General contractors and carpenter, Belleville & Bolan. Heating and plumbing, Germain Bros.

Business Buildings and Industrial Plants

Barrie, Ont.
Bank, cost $12,000, for Bank of Toronto. Manager, H. A. Sims. Architect, F. Martin, Hamilton, Ont. Three stys., 25 x 90, stone construction, concrete foundation, electric lighting, plumbing. Plans drawn.

Caledonia, Ont.
Machine and moulding shops, cost $7,000. Owners and architects, Logan & Sons. White brick construction, electric lighting, equipment required. Plans in progress.

Copper Cliff, Ont.
General office for Canadian Copper Co. President, A. P. Turner. General contractors, Henderson & Angus. Purchasing Agent, Mr. Todd, care company. Two storeys, 140 x 80, mantels, built-in fireplaces, library fittings, bank fixtures, screens, seating, time recording clocks, vacuum cleaner, fire extinguishers, vaults. About completed.

Store, cost $10,000, for Cochrane Hardware Co., Sudbury. Architect, W. Workman, Sudbury. General contractors, Henderson & Angus, Copper Cliff. Three storeys, 120 x 40, electric lighting, hot water heating, birch floors, plumbing, sheathed, plate glass, fireproof doors and shutters, store front, safes, fire extinguishers. Roofed.

Dundas, Ont.
Storage pattern shop. Owners and architects, John Bertram & Sons Co., Ltd. One storey, 25 x 150, steel and corrugated iron construction and roofing, special sliding doors. Plans in progress.

Edmonton, Alta.
Store and office building, $110,000, for Edwin Auld, 662 15th street. Architects, Cauchon & Van Tyne, care owner. Building to be completed early in 1914. 7-storeys, 150 x 25, steel construction. Tenders open.

Galt, Ont.
Factory, cost $10,000, for Galt Knife Co., Ltd. Manager, Thos. Vair. General contractor and carpenter, Peter Nisbet, Henry St. Mason, Thomas & Hancock, Wellington St. Address communications to manager. Forge, store room, grinding room, boiler room and office. One storey, 45 x 140, concrete foundation, Milton brick construction, flat roof, steel window frames, vaults. Foundation partly n.

Glencoe, Ont.
Garage, cost $7,000, for Alex. Duncanson. General contractors, McPherson & Clarke. Two storeys, 40 x 70, white brick construction. Excavating.

Hamilton, Ont.
Warehouse, cost $16,000, for Geo. H. Rillett, 830 Main St. E. Architect, A. W. Peene, King St. W. General contractor, Geo. F. Webb, Wentworth St. S. Four storeys, 60 x 100. Walls started.

Bank for Bank of Nova Scotia, Head Office, Toronto. General contractors, Harris & Harris, Confed. Life Bldg., Toronto. Office and bank furniture and fixtures required. Plastering.

Kingston, Ont.
Machine shop, cost $68,000, for Canadian Locomotive Co., Ltd., Ontario St. Steel, Hamilton Steel & Iron Co., Ltd., Hamilton. To be erected between Earl and Gore streets. One storey, 278 ft. long, concrete foundation, brick construction, wooden reg. steel supports. Work to start.

Laval Rapids, Que.
By-law has been passed for factory for manufacture of pipes, in which Mr. Souillard, Mayor of Laval Rapids, is interested.

Leamington, Ont.
Addition to vinegar factory, cost $15,000, contemplated by H. J. Heintz Co. Manager, R. A. Logan. Architect, Company's staff. Equipment required.

Addition to factory, cost $50,000, for H. J. Heintz Co. Architect. Co.'s staff. Four storeys, 90 x 190, white brick construction, stone and cement foundation, electric lighting, maple, pine and concrete floors. Equipment required. Plans in progress.

London, Ont.
Creamery, cost $15,000, is contemplated by Silverwoods, Ltd. Manager, A. E. Silverwood. One storey, 35 x 100, reinforced concrete construction, concrete foundation, electric lighting, machinery required.

Lulu Island, B.C.
Factory contemplated by The Morrison Steel & Wire Co., 831 Powell St., Vancouver. Site purchased, 16 acres. Work not to start for some time.

Montford, Que.
Hotel, cost $100,000, for E. J. Shepherd, c/o Mr. Cromack, 60 Notre Dame E. Note corrected address.

Montreal, Que.
R. J. Young & Co., 179 St. James St. Nothing further will be done in the matter of projected dairy till new year.

Newport, B.C.
Foley, Welch & Stewart, 739 Hastings St., W. Vancouver, may erect a second sawmill 14 miles north of Newport, to cut ties and bridge timber.

North Sydney, N.S.
Cable office, cost $75,000, of Western Union Telephone & Telegraph Co., Ltd. Supt., W. E. Earle. General contractor, F. C. Redding. To be completed about the middle of Feb. Two storeys. Roofing.

Ottawa, Ont.
Business block, cost $145,000, for American Bank Note Co., Wellington St. Architect, J. A. Ewart, 193 Sparks St. Trimming interior.

Stores, cost $25,000. Owner and architect, N. D. Porter, Bank and Albert Sts. General contractor, R. Holmes, 80 Arlington. Heating and plumbing, M. M. O'Connell, 212 Gloucester. Electrical, J. A. Ellacott, 226 Bank St. Painting, day labor. Four storeys. Roofed.

Store and residence, cost $6,000. Owner and architect, F. E. Brunet, 145 Beechwood Ave. General contractor, Joseph Whelan, 1 Beechwood. Brick veneer construction, stone foundation, felt and gravel roofing, electric lighting, hot air heating, birch floors, plate glass, store fronts and fixtures. Excavating.

Addition to Bank of Montreal, Wellington St., cost $15,000. Architect, C. P. Meredith, 126 Sparks St. Roofed.

Extension to stores is contemplated by J. A. Laroque, 262 Dalhousie Street. Brick veneer construction, stone foundation, felt and gravel roofing, electric lighting, hot air heating, pine floors, plate glass, store fronts and fixtures.

Alterations to store contemplated by Lord Furniture Co., Rideau St. Interior alterations, fixtures and fronts. Work to go ahead at an early date.

Store extension is contemplated by A. P. Johnston, Bronson Ave. Stone foundation, brick veneer construction, felt and gravel roofing.

Alterations to Federal Hotel. Architect, C. J. Burritt, 193 Sparks St. Work started.

Stores and residences, cost $12,000. Owners and architects, Oakland Land Co., c/o W. J. Spratt, Sunnyside Ave. Two storeys, 50 x 50. Walls started.

Business block, cost $100,000, Albert, for Mrs. Cowie, Albert St. Architect, C. P. Meredith, 126 Sparks St. Trimming interior.

Business block, cost $100,000, for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Seven storeys. Roofed.

Factory, cost $14,000, for M. J. O'Brien, Raglan Place, Renfrew. General contractor, A. E. Spooner, Windsor House. Electric not let. Two storeys. Roofed.

Business block, cost $145,000, for American Bank Note Co., Wellington St. Architect, J. Albert Ewart, 193 Sparks St. Plastering, none. Painting, Geo. Higman & Sons, 176 Rideau St. Heating and plumbing, McKinley and Northwood, Rideau St. Roofing.

Prince Albert, Sask.
Offices, cost $40,000. Owners and general contractors, Craag & Co. Three storeys, 50 x 100. Above project is held over until next spring.

St. John, N.B.
Bank, cost $20,000, Main, for Royal Bank of Canada. Manager, T. B. Blair, King St. Architect, K. G. Rea, 54a Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke St. Electrical, Frank E. Jones, Prince William St.

Bank of British North America, Market Sq., cost $50,000. Architect, G. E. Fairweather, 84 Germain St. General contractors, B. Mooney & Sons, 112 Queen St. Marble and tile work, Dom. Floor & Wall Tile Co., Montreal. Safe and vault equipment, J. & J. Taylor, 145 Front St. E., Toronto, Ont. Roofed.

Stratford, Ont.
Farquharson-Gifford Co.'s factory, Douro St. Architect, J. S. Russell, 21 Downie St. General contractors, J. L. Young, 240 Birmingham St. Four stys. About completed.

Sudbury, Ont.
Warehouse, cost $17,000, for Harris Abattoir Co., Ltd. General contractor, D. L. Brown. Refrigerating machinery may be required. Two storeys and basement, 200 x 60, felt and gravel roofing, electric lighting, hot water heating, temperature regulators, maple floors, plumbing, hard wall plastering, wood and metal lath, wire glass, one freight elevator, fire-

(Continued on page 147)

Tenders and For Sale Department

TENDERS

FOR

A Complete Mechanical Filtration Plant, Boilers, Steam Turbo-Generator Plant, and all Appurtenances

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, January 20th, 1914**, for the installation of a complete Mechanical Filtration Plant, Boilers, Steam Turbo-generator Plant, and all appurtenances at Toronto Island.

Specifications and tender forms may be obtained upon application at the office of Mr. James **Milne, Mechanical and Electrical Engineer, Department** of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or, in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
November 25th, 1913. 49-51

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharfs and Dredging at Rimouski, Que.," will be received at this office until 4 p.m., on **Monday, December 22, 1913**, for the construction of a line of Wharfs and Dredging Tidal Basin at Rimouski, County of Rimouski, Que.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Rimouski, Que.; Post Office Building, Quebec; Post Office, St. James St., Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43493. 49-50

TENDERS

Tenders for the Dredging of "Cow Creek Drain" will be received by the undersigned up to **December 15th, 1913.** For specifications, etc., apply to Alf. Hellier, Reeve of Sarnia Township. 50

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Hanover, Ont.," will be received at this office until **4** p.m. on **Monday, December 22, 1913**, for the construction of a Public Building at Hanover, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Hanover, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 28, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47226. 49-50

ENGINE FOR SALE

Second-hand 12 x 30 Wheelock Engine made by Goldie & McCullough, Galt. In good condition, low price, can be seen at our works.

Canada Printing Ink Company, Limited,
50 Toronto, Ont.

TENDERS

FOR

Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 16th, 1913.**

1. Asphalt (Refined).
2. Paving Blocks (Vitrified).
3. Granite or Stone Setts.
4. Treated Wood Blocks.
5. House Numbers.
6. Iron and Steel.

Specifications and tender form for any of the foregoing, may be obtained upon application at the Accounting and Purchasing Section of the Department of Works, Room 12, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders, the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto, Dec. 1, 1913. 50-51

FOR SALE

Steam Driven Air Compressors

thoroughly refitted

One 1,000′ Machine, Duplex Type, Compound Steam, Compound Air.

One 1,200′ Machine, Duplex Type, Compound Steam, Duplex Air.

For particulars and prices write

The Jenckes Machine Company

SHERBROOKE, QUE.

Montreal Office, - - - - - E. T. Bank Building

50-53

Canadian Pacific Railway Company

North Toronto Grade Separation

Notice to Contractors

Sealed proposals will be received by the undersigned up to 12 o'clock noon on **Saturday, December 27th**, for furnishing labor and material in connection with the waterproofing of eight subways at North Toronto.

Plans and specifications may be seen at the office of the Engineer of Grade Separation at No. 262 Avenue Road, Toronto, where proposal forms may also be obtained.

The lowest or any tender not necessarily accepted.

B. RIPLEY,
Engineer of Grade Separation.
Toronto, Dec. 4th, 1913. 50

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, December 16th, 1913**, for the construction of the following works:—

SEWERS

Annete St., from Quebec Ave. to Runnymede Rd.
Blackburn Ave., from Gerrard St. to Mount Stephen St.
Clifford St., from Walnut St. to Niagara St.
Danforth Ave., from Hillingdon Ave. to Woodbine Ave.
Gerrard St. and Hiawatha Rd. to Gerrard St. and Eighth Ave., via Gerrard St., Coxwell Ave. and Gerrard St.
Lane 1st W. of Grove, Foxley St. to 232 ft. N.
Moore Park Drainage System, Western Section Outlet No. 1, from Rosehill Ave. and Grace Terrace to Summerhill Ave. and MacLennan Ave. via Grace Terrace, Rosehill Ave., Clifton Rd., Oakwood Drive, Sighthill Ave. and Summerhill Ave.
Moore Park Drainage System, Western Section, Outlet No. 2, Grace Terrace from Rosehill Ave. to Clarence Street.
Norway Place, Woodbine Ave. to 620 ft. East.
Orchard Park Blvd., Orchard Park Rd. to E. End.
Oriole Parkway, Oriole Rd. to 122 ft. North of Gormley Ave.
Waverley Rd. North Limit Lot 48, Plan M. 252, to S.S. Kingston Road.
Warram Place, Belaise Drive to 100 ft. South of Belsize Drive North.
Woodbine Ave., Kingston Rd. to N. City Limits.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tenders obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto), or in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor.
Chairman, Board of Control.
Toronto, Dec. 3rd, 1913. 50

WANTED—Electrical man with knowledge of gasoline engines to sell and erect small isolated electric light installations. Good opportunity for young man. Reply giving age, experience and salary required, to Box 916, Contract Record, Toronto. 49-50

Business Buildings and Industrial Plants

(Continued from page 145)

proof doors and shutters, packing house fittings, fire extinguishers. Roofing.

Toronto, Ont.

Factory, cost $8,000, for S. B. Hinder, 109 Heath St. W. Architect, E. G. Wilson, 77 Victoria St. General contractor, J. W. Gratton, 488 Clinton St. Contract let on percentage basis. Two storeys, 49 x 61, brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, concrete and birch floors, galvanized iron, metal, sash, fireproof doors.

Warehouse for H. Greisman, 68 Adelaide E. Architects, Chadwick & Beckett, 18 Toronto St. General contractors, Consolidated Building & Supply Company, 104 Temple Bldg. Four storeys, 48 x 120. Roofed.

Four attached stores and residences, $10,000. Owner and general contractor, C. A. Scott, 625 Logan ave. Owner superintends construction and buys all material. Three storeys, 63 x 42, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot air heating, oak, spruce and birch floors, lime and sand plastering, wood lath, plate glass, built-in fireplaces, mantels. Plans drawn.

Brass foundry. Owner and general contractor, Jas. Sherlock, care Monarch Brass Co., 278 Dundas street. Brick construction and foundation, felt and gravel roofing, electric lighting. Plans drawn.

Theatre, cost $10,000. Owner and general contractors, M. J. Thaler & Son, 350 College. Architect, R. A. Abraham, 23 Jordan St. Trimming interior. To be opened about Dec. 15th.

Theatre, cost $6,000. Owner and general contractor, W. J. Bennett. 16 Howland Ave. One storey, 26 x 110, brick and steel construction, brick foundation, felt and gravel roofing, electric lighting, hot water heating, birch floors, lime and sand plastering, metal lath, plate glass, galvanized iron, store fronts and fixtures, seating. Tenders received by Owner.

Walkerville, Ont.

Dominion Bank of Canada, Head Office, Toronto, contemplate opening a branch. Bank fixtures, vaults, safes required.

Factory, cost $6,000. Owner and carpenter, W. E. Seagrave. Architects, Stahl & Kinsey. General contractor, H. Howe. Two storeys, 40 x 90, brick construction, concrete floors, patent roofing, metal sash, electric lighting, steam heating. Walls going up.

Stores and flats, cost $9,000, for C. L. Chilver. Architects, Smith & Walker. Tenders received by Architects after Dec. 15th. Two storeys, 80 x 30, cement and brick foundation. Plans in progress.

Winnipeg, Man.

Bank and office building, cost $225,000, for Quebec Bank. Architects, Brown & Vallance, 1006 McArthur Bldg. General contractors, Carter, Halls, Aldinger, Union Bank Bldg. Erecting steel work.

C. P. R. Hotel addition, cost $1,000,000. Royal Alexandria Hotel. General contractors, Westinghouse, Church, Kerr Co., Confed. Life Bldg. 12 storeys. Stone work up three storeys.

Yarmouth, N.S.

Bank for Canadian Bank of Commerce, head office, Toronto, Ont. Project abandoned.

Yarrow, B.C.

Shingle mill for J. H. Maddaugh, Vancouver. Work in progress.

CONTRACTS AWARDED

Ottawa, Ont.

Alterations to stores for Mrs. E. C. & S. H. Han, c/o General Contractor. Architect and general contractor, R. A. Kemp, 149 1st Ave. Carpentry, Esdale & Douglas, 318 Lisgar St. Plate glass, store fronts and fixtures.

Ridgetown, Ont.

Bank and offices, cost $12,000, for Royal Bank (W. A. Pow, manager). Architect, K. G. Rea, 54a Beaver Hall Hill, Montreal. General contractor, J. R. Sculland, Windsor, Ont. Two storeys, stone trimmings, Milton pressed brick construction.

Wilkie, Sask.

Skating and curling rink planned by Town Council. Sec.-Treas., T. A. Dinsley. General contractors, Hermanson & Hughes, Kerrobert, Sask. Frame construction, corrugated iron roofing, electric lighting, pine floors.

Residences

Bayfield, Ont.

Ten cottages, cost $10,000, contemplated by Deer Lodge Summer Cottage Co. (Geo. Rowntree, Stanley St.). Architect to be chosen. Frame construction, shingle roofing, pine floors.

Leamington, Ont.

15 residences, cost $25,000, contemplated by H. J. Heintz Co. Manager, R. A. Logan. Architect, Co.'s staff. Frame construction, shingle roofing, maple and pine floors, plumbing, lime and sand plastering.

Hamilton, Ont.

Four residences, cost $9,000. Owners and general contractors, McLarty & McNivin, 587 Barton St. E. 2½-stys., 17 x 35, brick construction, concrete block foundation, shingle roofing, gas and electric lighting, hot air heating, pine floors, plumbing, mantels. Excavating.

Montreal, Que.

Flats, cost $6,000. Owners and general contractors, Bourgon & Gagne, 1882 Notre Dame W. General contractors doing all trades. Two storeys, 25 x 66, felt and gravel roofing. Foundations in.

Flats, Notre Dame de Grace. G. A. Kell, 2 Fortune, will probably call for tenders for General Contractor shortly for flats. Concrete foundation, brick construction, felt and gravel roofing, electric lighting, hot water heating, pine floors, lime and sand plaster.

Residences, cost $7,000, Outremont. Owner and general contractor, A. Lafleur, 728 Champagneur Ave. Three storeys, 20 x 70, stone foundation, pressed brick construction, felt and gravel roofing, electric lighting, hot water heating, hardwood floors, lime and sand plaster, plate glass. Excavating.

Residences, cost $7,000, Outremont. Owner and general contractor, W. Ouimet, 1911 Esplanade, who wishes additional tenders on plastering. Contract to be let about Dec. 10th. Three storeys, [illegible]

Ottawa, Ont.

Residence, $10,000, for Mr. Quinn, care architect, F. C. Sullivan, Castle Bldg., Queen St. General contractor, T. A. Shore, 41 Chamberlain. Roofed.

Residences, cost $10,000, contemplated by Donald Fraser, 557 McLead St. Stone foundation, brick veneer construction, shingle roofing, electric lighting, hot air heating, birch floors, water heaters, built in fireplaces.

Residences, cots $8,000. Owner and architect, J. P. MacLaren, 104 Sparks St. General contractors, Bellfoy Bros. Mason, R. Edmondson, 221 Somerset St. Carpentry, R. J. Mackie. Other contracts not let. 2½ storeys, brick veneer construction. Foundations in.

Apartments, cost $14,000. Owner, Mrs. C. E. Hesser, 424 Lisgar St. Architect, A. Tracey, Gladstone Ave. 60 x 44. Foundations in.

Quebec, Que.

Seven flats, cost $9,500, for owner, architect and general contractor, Jos. Art Godin, 269 St. Denis. Day labor. Four storeys, 47 x 66, felt and gravel roofing. Roofing.

St. John, N.B.

Residence, cost $10,000, for Jno. Seeley, 100 Leinster St. Architect, F. Neil Brodie, 42 Princess St. General contractor, Jno. Flood, 123 Duke St. Roofed.

Toronto, Ont.

Residence, cost $7,000, for J. M. McKinley, 16 Dalton Rd. Architect, C. J. Gibson, 53 Yonge St. General contractor, A. J. Peppiatt, 81 Hilton. 2½-stys., 30 x 46, brick construction, slate roofing, gas and electric lighting, steam heating, oak and birch floors, lime and sand plastering, wood lath, marble tiling, art glass, mantels, built in fireplaces. Foundations in.

Residence, cost $30,000, for Jas. Ryrie, 400 Jarvis St. Architects, Burke, Horwood & White, 28 Toronto St. Carpentry, J. G. Scott Lumber Co., River St. Plastering, R. C. Dancy, 153 Spadina Rd. Painting, J. McCausland & Son, 11 Nelson. Plastering.

Residence, cost $15,000, for C. J. Read (in trust). Architect, C. J. Read, Confederation Life Bldg. Masonry, S. Young, 41 Hazelton. Carpentry, M. J. Madden, 62 Wilson ave. Plastering, E. J. Curry, Lumsden Bldg. Painting, J. O'Connor, 64 St. Clarens ave. 2½ stys., 20 x 43.

One pair residences, $5,000. Owner and general contractor, E. Taylor, 162 Delaware ave. 2½ storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Three attached stores and residences, cost $8,000. Owner and general contractor, W. Hughes, 24 Biggar Ave. Owner superintends construction. Three stys., 48 x 52, brick and steel construction, stone foundation, felt and gravel roofing, gas and electric lighting, hat water heating, oak, spruce and birch floors, lime and sand plastering, wood lath, plate glass, built in fireplaces, mantels, store fronts and fixtures. Plans drawn.

One pair residences, cost $5,000. Owner and general contractor, A. & A. Grant, 837 Logan ave. Owners superintend construction. 2½ storeys, 33 x 40, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Apartment, cost $6,000, for W. H. Mallory (in trust), 31 Queen St. W. Architect, W. H. Mallory. Tenders received by Architect. Three storeys, 24 x 60, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and birch floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Plans drawn.

Vancouver, B.C.

Apartment house, cost $20,000, for E. French, care architect, Raphael A. Nicolais, Birks Bldg. Two storeys and basement, two 50-ft. buildings with central court between, frame and brick veneer construction. Nine apartments on each floor, disappearing beds to be installed Plans in progress.

Walkerville, Ont.

Farm residence, cost $12,000, for Frank Walker. Architect, Stahl & Kinsey. General contractors, Schmeid-Sisman, 387 Beaufort Ave., Detroit, Mich. One and two storeys, 58 x 35, frame construction, cement foundation, shingle roofing, electric lighting, hot water heating, oak, maple and pine floors, plumbing, built in fireplaces, garage and barn, incubators required by owner. Foundations started.

Six residences, cost $9,000. Owners, Walkerville Land & Bldg. Co. Architects, Stahl & Kinsey, Strathcona Block. General contractors, Schmeid-Sisman, 387 Beaufort Ave., Detroit, Mich. Plumbing, Walkerville Hardware Co., and Geo. Schmeid. Electrical, W. A. Richards. Plastering, Jas. Reid. Painting, H. B. White. Two storeys, 108 x 29, stove heating, plastering.

CONTRACTS AWARDED

Montreal, Que.

Apartment house, cost $20,000. Owner and general contractor, J. A. Joly, 1205 St. Viateur St. Architect, Z. Trudel, 238 St. Andre St. Brick, Mr. Laliberty, Champagneur Ave. All other contracts to be given shortly.

Toronto, Ont.

Two detached residences, cost $6,000. Owner, A. Pugsley, 50 Central Ave. General contractor, T. E. Valentyne, 606 Shaw St. 2½-storeys, 24 x 32, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and spruce floors, lime and sand plastering, wood lath, built in fireplaces, mantles.

Winnipeg, Man.

Residence, cost $40,000, for Col. R. M. Thomson, 802 Trust & Loan Bldg. Architect, C. W. N. Chivers, Keewayden Bldg. General contractors, roofing and painting, Jas. McDiarmid & Co., Canada Bldg. Heating and plumbing, Fraser Plumbing Co., 44 Adelaide St.

Apartment block, cost $65,000, Grosvenor Ave. D. H. Bradley, c/o Architect, H. B. Scarlett, 797 Jessive Ave. General contractors, Winnipeg Stone Co., Elmwood. Three storeys. Plastering.

Power Plants, Electricity and Telephones

Lacombe, Alta.

Purchase of generator, cost $2,000, is contemplated by Town Council. Engineer, E. J. Tett, Elec. Light Commr. Installing 100 kw. 2,300 volt engine Type 3-phase, 60-cycle, generator 277 r.p.m. with belted exciter.

London, Ont.

Addition to Hydro sub-station planned by City Council (Water & Light Commission). Chairman, Philip Pocock. General manager, Commission, H. J. Glaubitz. No tenders to be called as work will be done by day labor in spring.

Storage cell, etc., planned by City Council (Fire & Light Com.) Mayor, C. M. R. Graham. General contractors, Northern Electric & Mfg. Co., Ltd., 131 Simcoe St., Toronto. To be used in connection with fire alarm system.

Moncton, N.B.

Telephone train despatching line to St. John, cost $10,371, planned by Dominion Govt., Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General manager, Intercolonial Railway, F. Gutelius, Moncton. General contractors, Hall Switch & Signal Company.

Napanee, Ont.

Tenders received until Dec. 15th for electric wiring and fittings. Plans at office of Dept., Station "F," Toronto, and Caretaker of building, Napanee. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa.

Picnic, Sask.

The Graham-Chatsworth Rural Telephone Co., Ltd. Plans, etc., at the office of Sec.-treas., Victon Rooke, who will receive tenders for construction of telephone system.

Princeton, B.C.

Tenders will be received for poles, will require boilers, dynamos, lamps, wire and fittings. To be installed at once. Princeton Coal & Land Co. Manager, Ernest Waterman.

Rossland, B.C.

Municipal Council is looking into matter of installing new street lighting system. Futher information from Clerk.

St. Thomas, Ont.

Commission contemplates purchasing iron poles and installing cluster light system on main streets. City Council (Hydro Dept.). Manager Dept., E. H Caughell.

Winnipeg, Man.

Power house, cost $35,000, planned by Board of Control. Engineer, J. G. Glassco, City Light & Power Dept. General contractors, Ft. Garry Constr. Co., Ross and Arlington Sts. Roofed.

Motor generator set required by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Siemens Co. of Canada, Ltd., 707 McArthur Bldg. For supply and delivery of one 500 kw. motor generator set for the King St. sub-station at cost of $9,740.

Wyoming, Ont.

Town Council contemplate installing electric lighting system. Clerk, H. G. Taylor.

The John Inglis Company
Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

The Lakewood Line

Lakewood Concrete Mixers, all sizes, steam, gasolene or electric power.

Made for heavy work.

Built to Last.

Immediate shipment.

Lakewood Steel Hoist Towers

Lakewood Concrete Chute

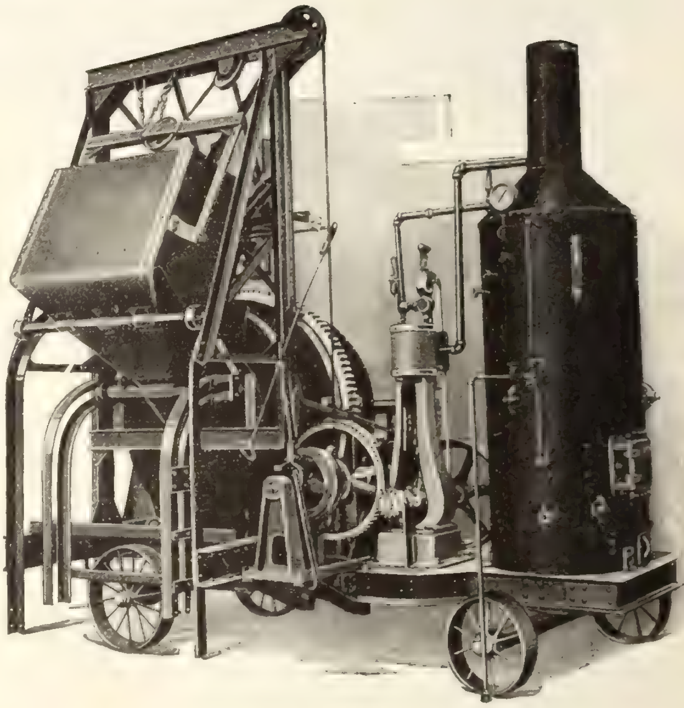
Lakewood Steel Buckets

Lakewood Steel Cars

Lakewood Steel Track

Let us design your complete Concrete Plant.

Write for Catalog



Ohio Ceramic Engineering Co.

Home Office, Cleveland, Ohio

Canadian Offices

A. D. Masson, 30 St. Nicholas St., QUEBEC
Waite-Fullerton Company, Limited, WINNIPEG
Waite-Fullerton Company, Limited, REGINA

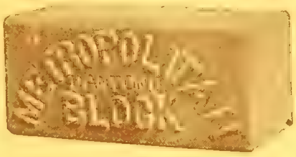
Canadian Western Builders Supply Co., SASKATOON
Western Supply & Equipment Company, CALGARY
Western Supply & Equipment Company, EDMONTON

Western Supply & Equipment Company, LETHBRIDGE

To City Officials:

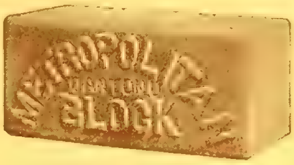
Remember that "Metropolitan" (Canton, Ohio Shale) Paving Block are endorsed by City Engineers, Experts, and hundreds of cities.

"Best Paving Block Made"



Experts have analyzed and tested our Shale and Paving Block—they use them as a standard for highest quality.

"Best Paving Block Made"



Every time you use "Metropolitan" Wire-cut-lug or Repressed Block, you get a permanent pavement.

"Best Paving Block Made"

The Metropolitan Paving Brick Co.

CANTON, OHIO, U. S. A.

South Sixth Street, Terre Haute, Indiana, was paved with vitrified brick in 1892. During the 21 years intervening this pavement has carried its full share of the traffic of this hustling city—population 36,000 in 1900; 58,000 in 1910, and probably 65,000 in 1913.

The accompanying photograph shows the condition of the pavement on this street today. The pavement is not merely still in use—but has grown more perfect with age. The wear is scarcely discernible to the eye or measurable with an instrument. What is more, it looks good for at least another 21 years.

What other type of pavement actually stands up in service like properly laid vitrified brick?

The pavement on this street was laid according to the methods developed and approved by this Association. Only very slight revisions in these original methods have been found necessary after years of experience.

The recent edition of our "No. 1 Directions for Laying Vitrified Brick Street Pavements" and "Work Scenes," illustrated, give approved methods in detail for street and road building.

These specifications or any other information regarding brick pavement furnished on request.

National Paving Brick Manufacturers Association

WILL P. BLAIR, Secretary, Engineers Bldg., CLEVELAND, OHIO

The Permanent Way

"Brick when properly made and scientifically laid makes the best and most durable pavement ever devised by man."

Wire-Cut-Lug Blocks on New York State Highway, between Buffalo and Orchard Park.

The Dunn Wire-Cut-Lug Brick Co.

(Licensors)

CONNEAUT, OHIO

Patented in Canada

Monroe Ave., Grand Rapids, Mich.—Paved with Bessemer Block

WHEREVER used **"BESSEMER BLOCK"** have given satisfaction in the paving of light, medium and **heavy traffic** streets.

There are two steps necessary to obtain a good pavement :—*First,* the Selection of the material. *Second,* Proper Construction.

First select Bessemer Block and the rest is up to the Engineer.

Bessemer Limestone Company

Youngstown, Ohio

Manufacturers of **Vitrified Bessemer Block, Repressed or Dunn Wire-Cut-Lug**

United States Home for Disabled Volunteer Soldiers, Hampton, Va.
250,000 White and Red Brown "AMERICAN" Enameled Bricks used for the interior lining of the various departments of this Home.

MODERN BRICK CONSTRUCTION

For this Home the United States Government demanded the highest standard of brick perfection. Even the interior walls of the Hospital Ward (see cut) are built of

"AMERICAN" Enameled Brick

to afford a bright, clean and thoroughly sanitary finish.

Write for Fifth Edition Catalog, illustrating the standard sizes, colors and some of the special shapes.

SAMPLES—Miniature or full size, forwarded, all charges prepaid. Prompt attention given formal inquiries.

(See Sweet's Catalog, pages 122 to 131)

AMERICAN ENAMELED BRICK AND TILE COMPANY, 1182 Broadway, New York

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A High Grade Paving Block for City Streets and Main Highways

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Buffalo-Glenwood Road, 21 miles, New York State Highway, constructed June 1911. Photo, June 8, 1912, at Station No. 369. 13 miles from Buffalo City Line.

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¶Vitrified Brick when properly made and scientifically laid makes the best and most durable pavement for permanent highways.

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"Car-Bex" Bricks

ANTE-FIRED-PROCESS
DRY AS THE DESERT
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CLAY PRODUCTS

This Trade Mark stands for all you can ask in Manufactured Clay.

"Durability - Beauty - Individuality"

Produced by the Roman Ante-Fired Process. Result:

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I would like to know more about
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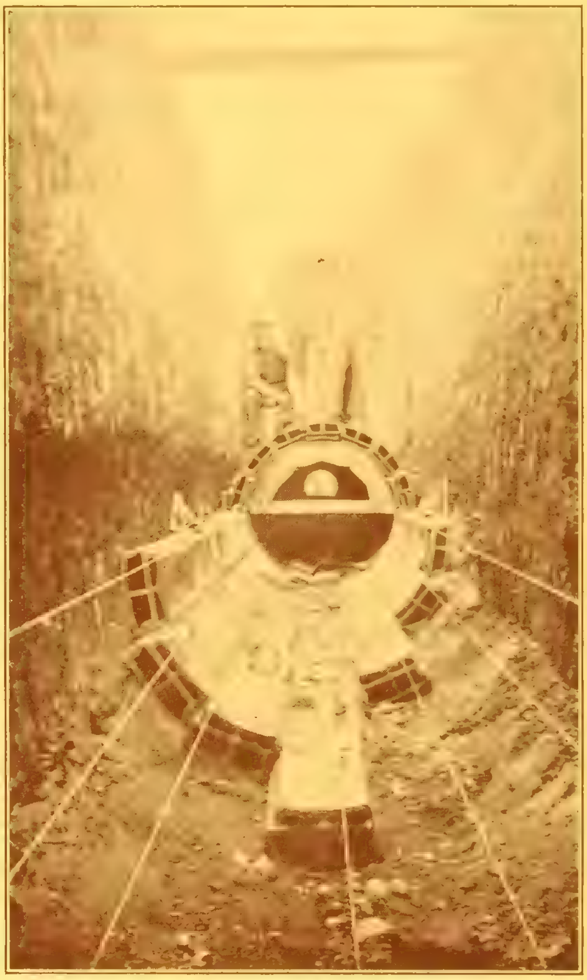
AMERICAN SEWER PIPE COMPANY'S PATENTED

Vitrified Salt Glazed Interlocking Segment Sewer Blocks

Made for sewers from 30 to 108 inches in diameter



Photograph of our Segment Blocks used in the Wascana Valley Sanitary Trunk Sewer, Regina, Sask.

"The above picture shows a 45-in. sanitary sewer, constructed something over a year ago in Regina, where the trench was excavated by a trenching machine about a foot deeper than the outside of the sewer, and the bottom filled in with material dug out of one side of the trench to make it wide enough for the sewer. This method in a twenty-foot trench saved nearly ten per cent. in excavation, and had concrete pipe been used this saving could not have been made. This sewer is entirely satisfactory, as is absolutely every sewer of several hundred that have been constructed of this material. It is of burnt clay, glazed and smooth, thoroughly vitrified and therefore practically indestructible, very easily constructed, and the cost often less than that of sewers constructed of doubtful material.

Note that the shiplap provides an efficient end-joint, and the tongue and groove effect a proper side-joint. By "breaking" joints in the laying a continuous structure, as strong at one place as another, is secured.

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CONSTRUCTED IN SIX MONTHS.

Substructure of 965′ BRIDGE—Some of these piers were carried to a depth of over 100′ below water level, by pneumatic caissons.

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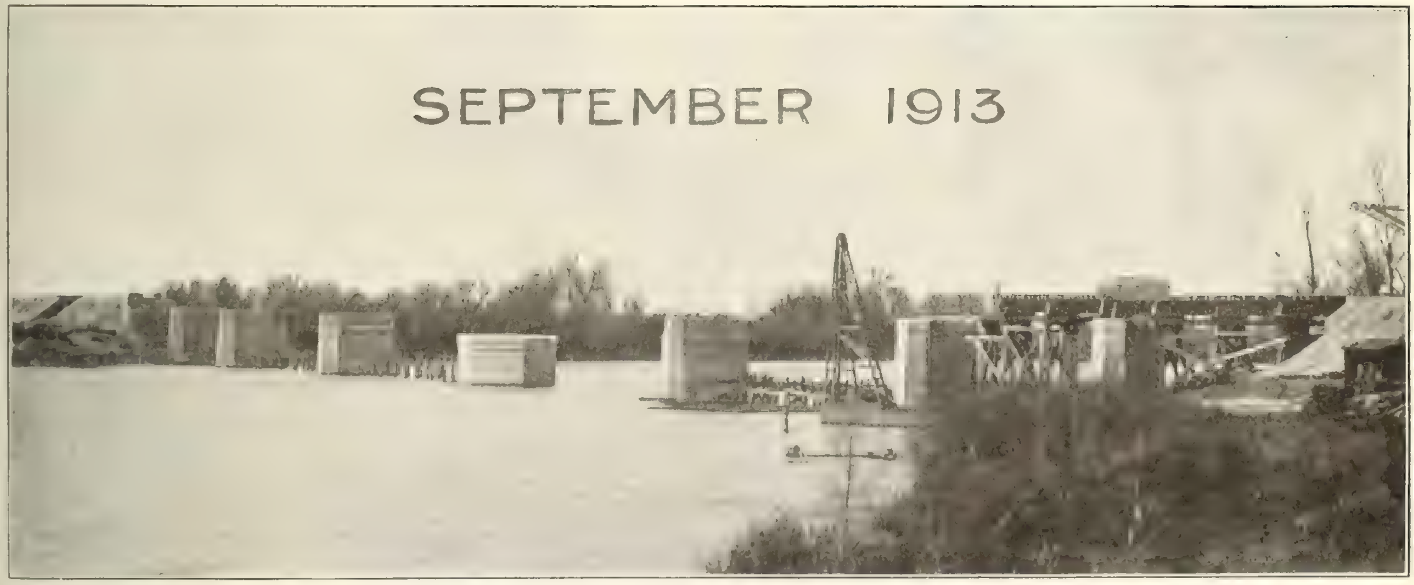

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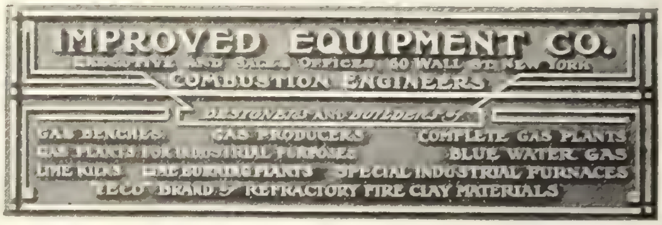
Large stock I Beams, Channels, Angles, Tees, Zees, and Plates always on hand.



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"IECO" BRAND OF REFRACTORY FIRE CLAY MATERIALS

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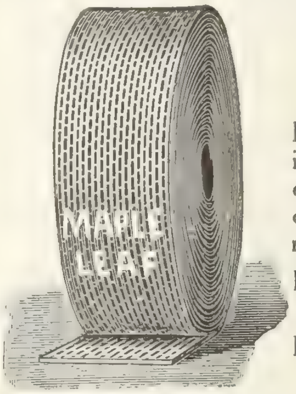
Has Become a Habit with Superintendents and Engineers.

The reason is not hard to find, for there is no part of your Belting system, from the main drive to the smallest light Belt for power transmission, where you will not get the best kinds of service from



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It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

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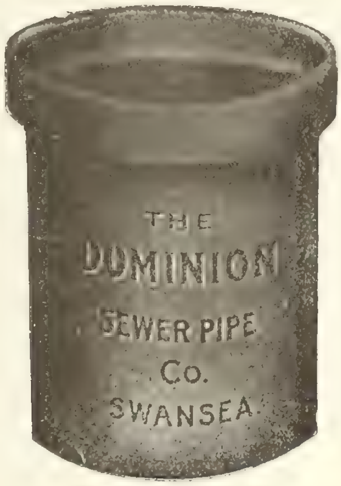

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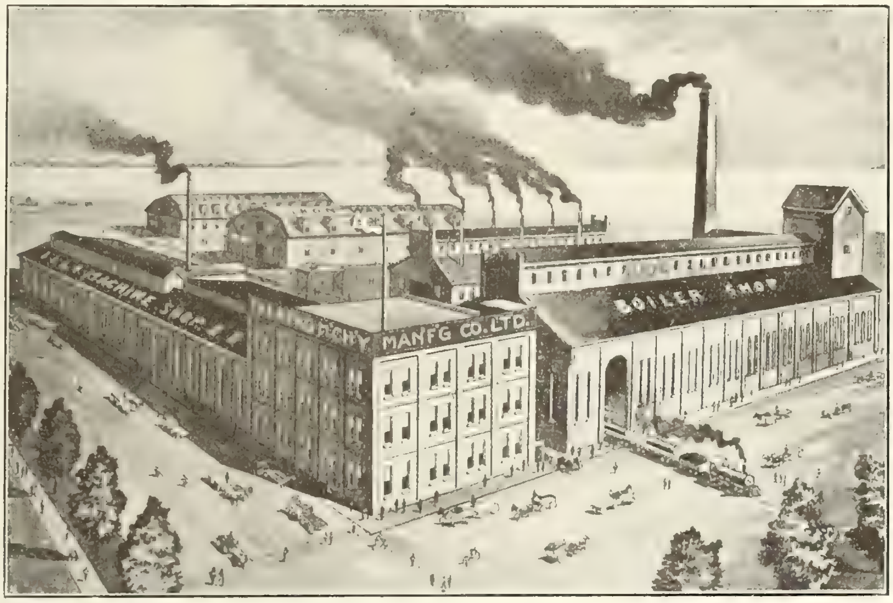

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Entire process takes 24 hours and are then ready to be built in the wall.

This view shows a days run of brick in a 20,000 capacity plant ready for shipment

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They can be made every day regardless of weather conditions.
Sand-Lime Bricks made by "Berg System" stand 3000 to 6000 pounds pressure per square inch.
Many colors and shades can be produced.

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The highest grade, most economical and efficient.

TURN YOUR SAND BANK INTO THIS PROFITABLE PLANT

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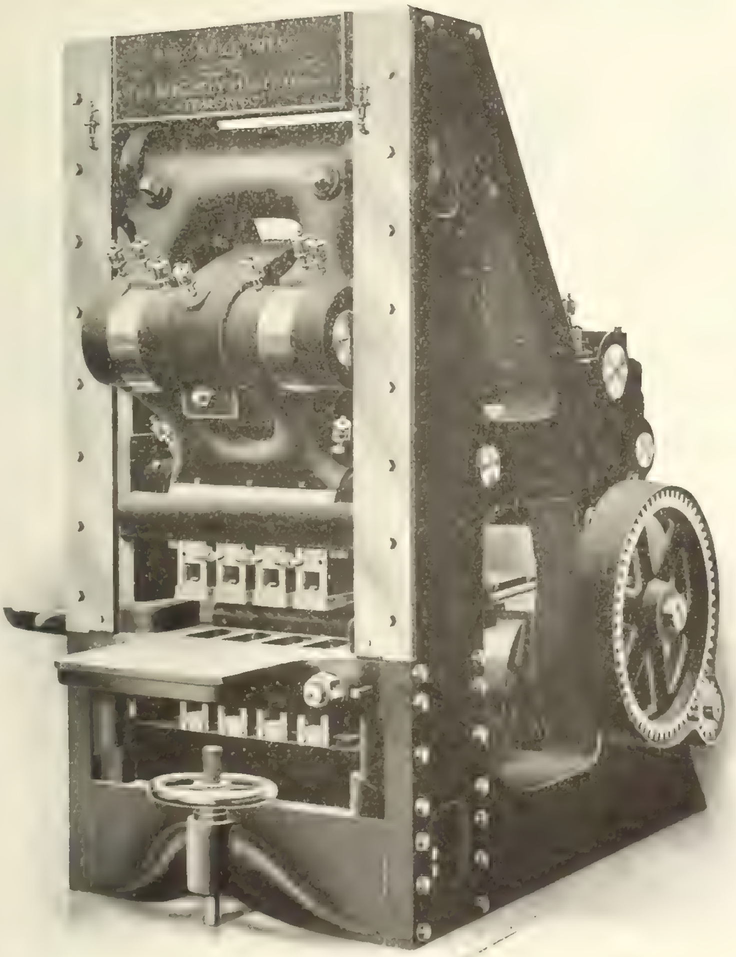

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Daily capacity of plant, 40,000.
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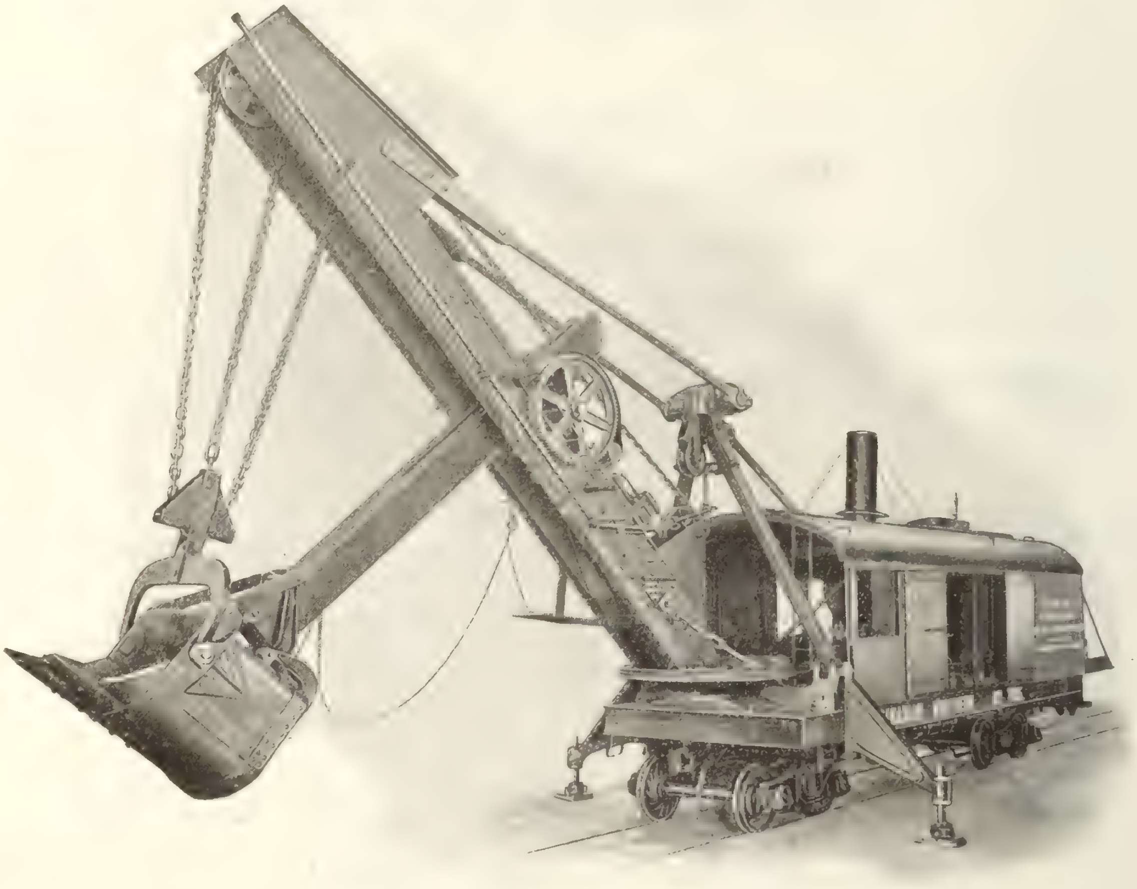
THE ONLY HEAVY DUTY STEAM SHOVELS
BUILT IN CANADA



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We build in our Davenport Works, Toronto, Steam Shovels 70 to 110 ton, and carry a complete stock of repair parts.

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Manufacturers of:—Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Wheels.

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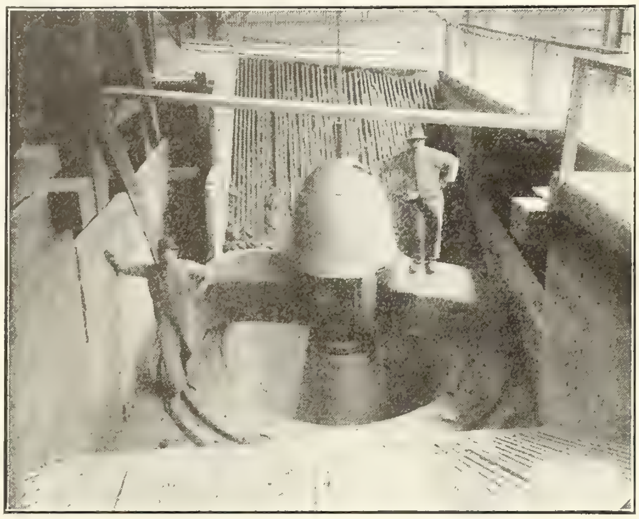
COMPLETE

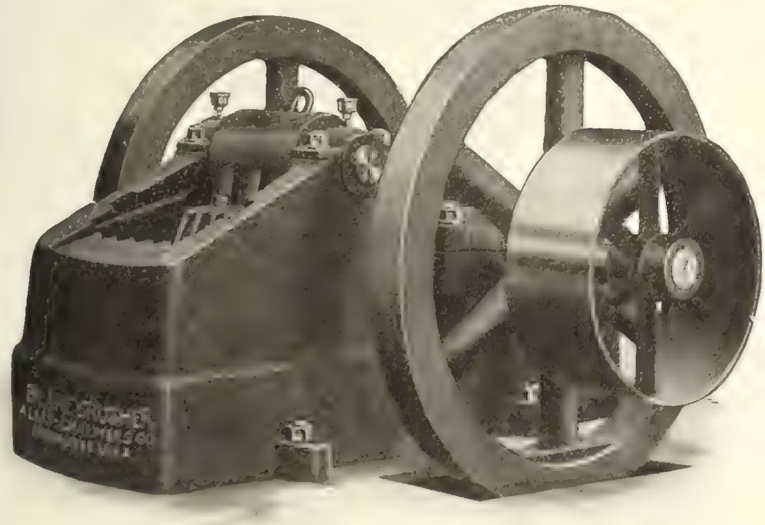
ROCK CRUSHING PLANTS

Including breakers, gyratory or jaw, elevators, screens, conveyors and all power equipment.

Note the size of the opening of this machine 42″ x 96″. This wide opening is characteristic of all Gates "K" Breakers. The high arched spider permits free access to the crushing surfaces and prevents bridging.



Gates "K" Breaker.



Although no form of jaw crusher is equal to Gates Gyratory Breaker, the jaw crusher is preferred when small initial expenditure is important or when a small machine with large opening is required and great capacity is not essential.

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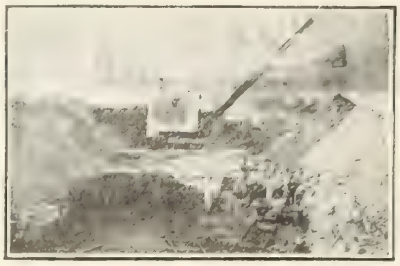

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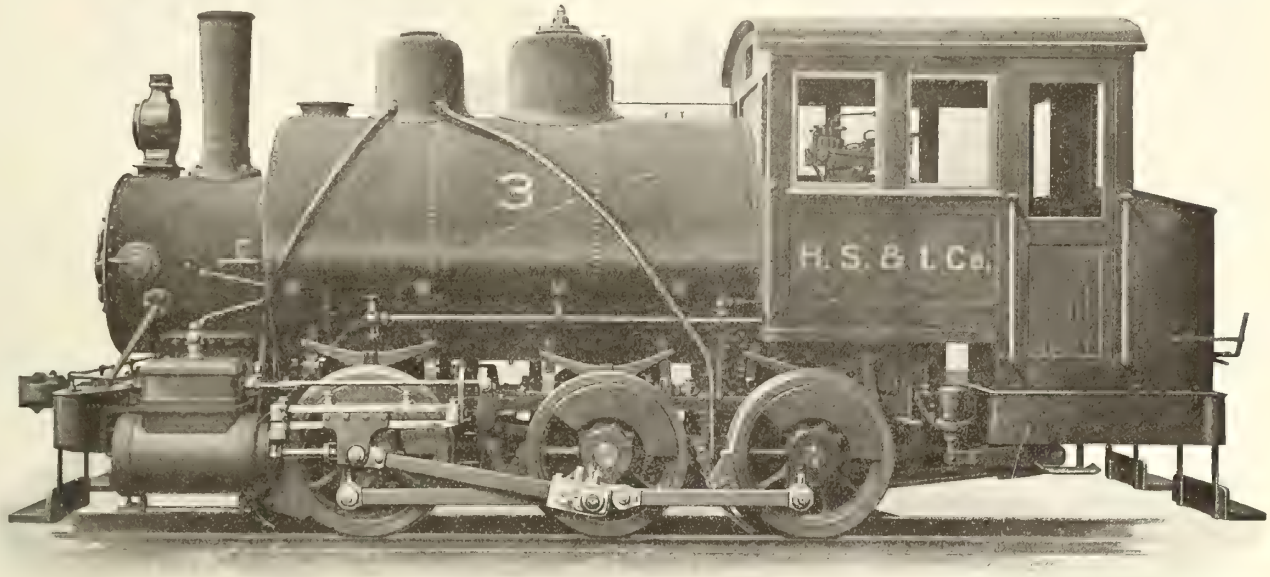

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We will quote you attractive prices on any of the above—write us.

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Roofing and Sheet Metal Contractors

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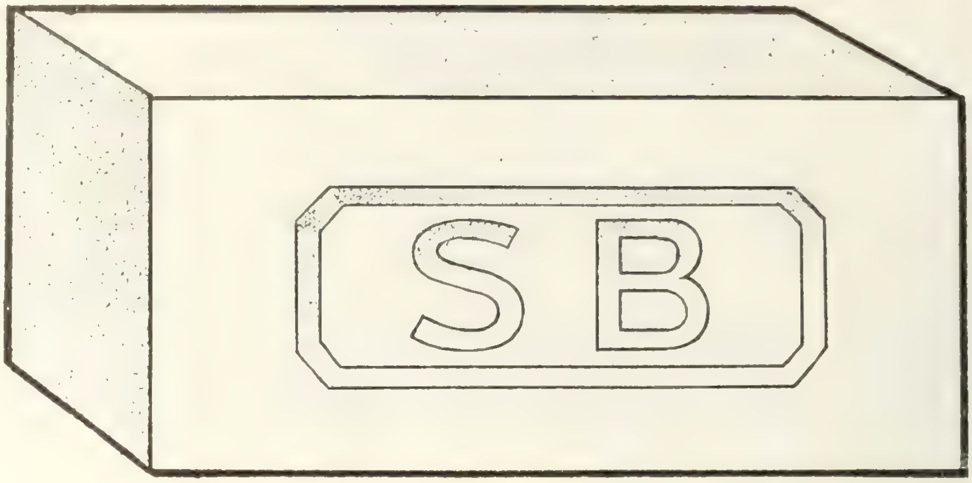

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SILICA PRESSED BRICKS

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—**Appearance.**—Natural color, similar to light gray sandstone. Do not stain.
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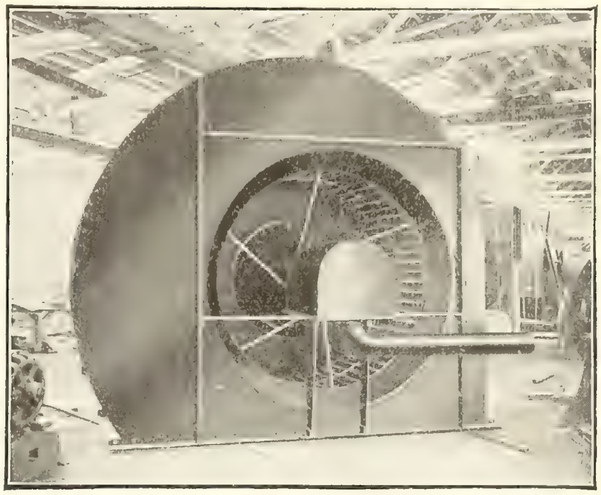

Typical "Sirocco" Waste Heat Fan with hood over bearing for cooling.

Dry Brick with Waste Heat. An otherwise wasted element is made to do valuable work by the installation of

"Sirocco"
TRADE MARK

Waste Heat Fans

The heat from the cooling kilns is reclaimed by the "Sirocco" Drying System and delivered into the dryers at a cost so much less than that of operating a steam dryer as to be almost insignificant.

The cost of operating a "Sirocco" System is limited to the power consumption of the fan, which, because of their high efficiency, is low.

You should know what "Sirocco" Waste Heat Fans will do for you—Write now.

Have our Engineering Department tell you how to dry brick by the "Sirocco" System — Write for information.

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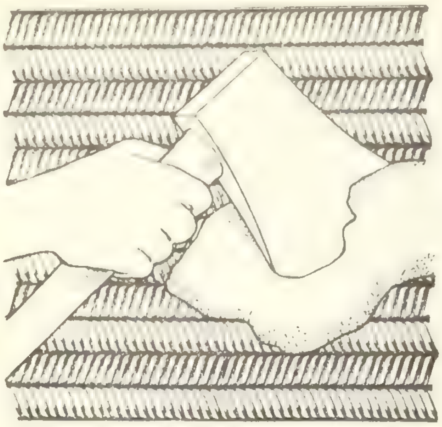
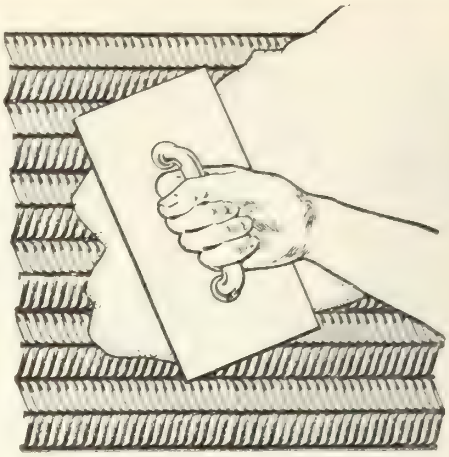
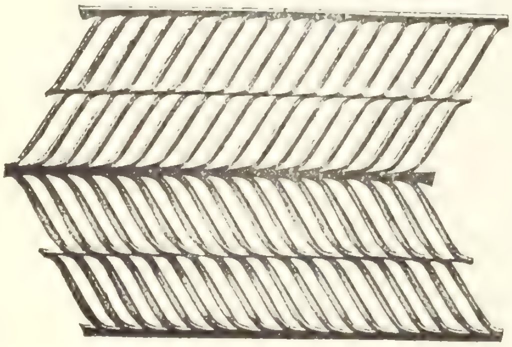


Who will cover the most lath, the man with the axe, or the man with the trowel?



The plasterer uses a trowel because it presents a flat surface on the mortar and spreads it.

HERRINGBONE LATH



and the trowel work together, which permits first class work to be done with great speed. The diagonal strands of HERRINGBONE LATH present a flat surface to the mortar spreading it instead of cutting it.

The extreme rigidity of HERRINGBONE LATH permits the lather to erect at least 10 per cent. more lath than is possible when using other makes. This rigidity also affords a firmer plastering surface than any other make of lath.

HERRINGBONE LATH gives you all the quality requisite in a metal lath to secure perfect satisfaction at the lowest possible price.

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Enquiries We will be pleased to have your specifications and enquiries, which will have our prompt attention. No inquiry too small to figure on.

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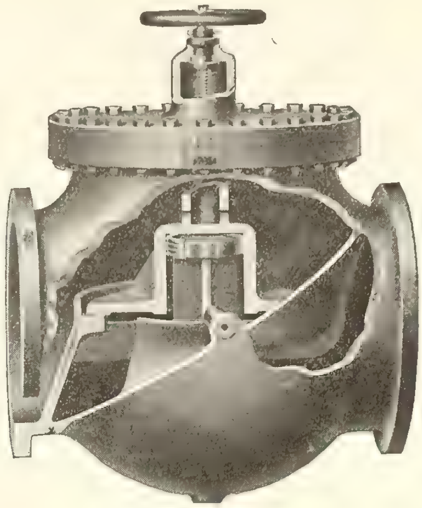

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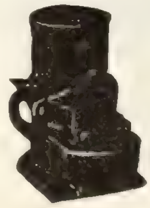

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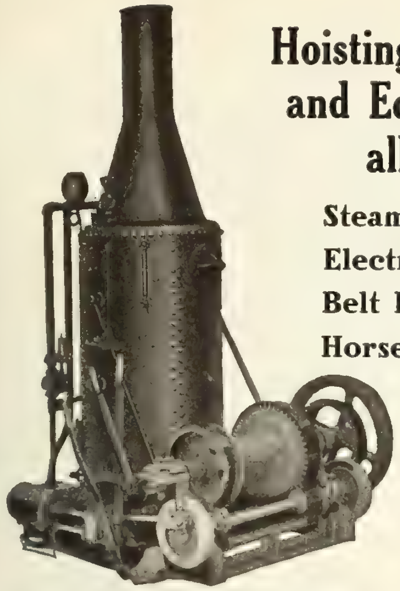

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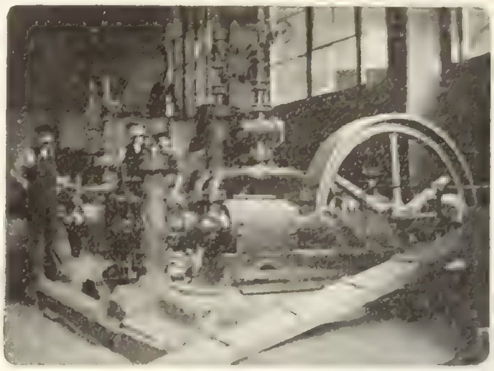
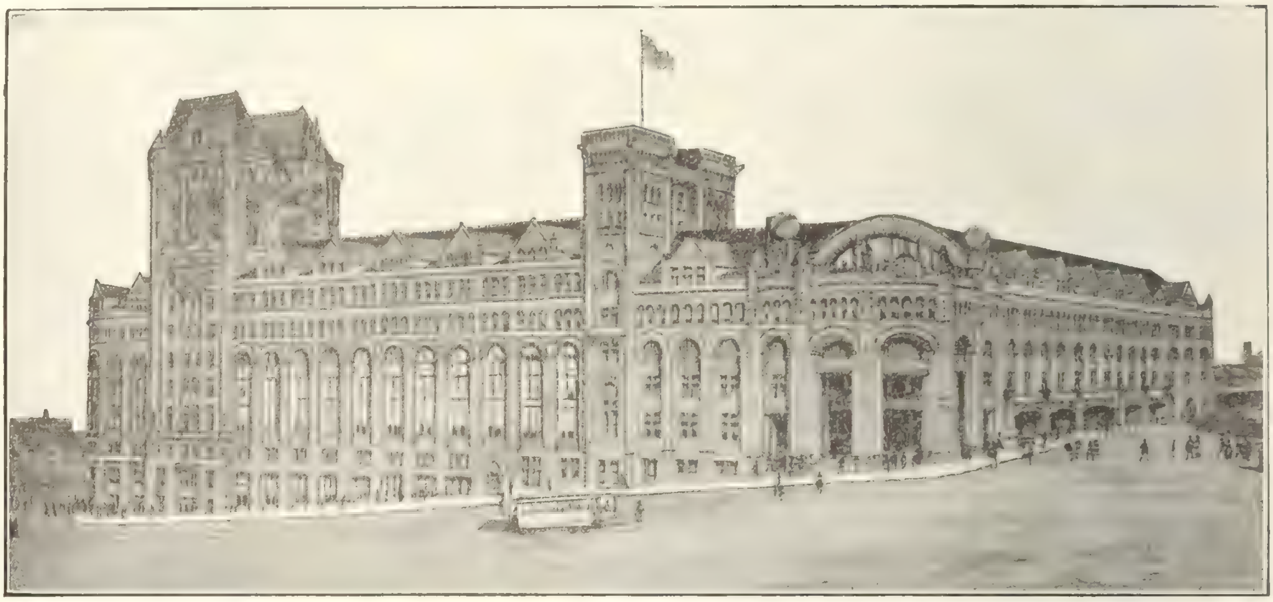


Plant in course of construction
at Windsor Station



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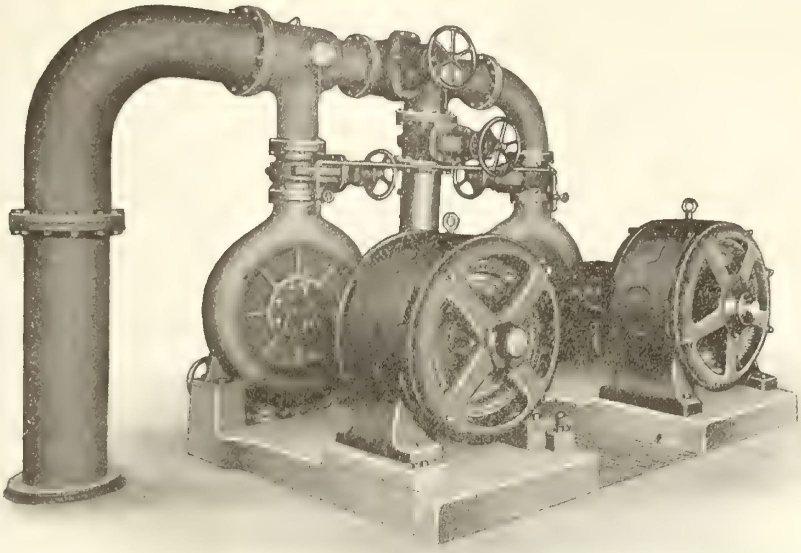

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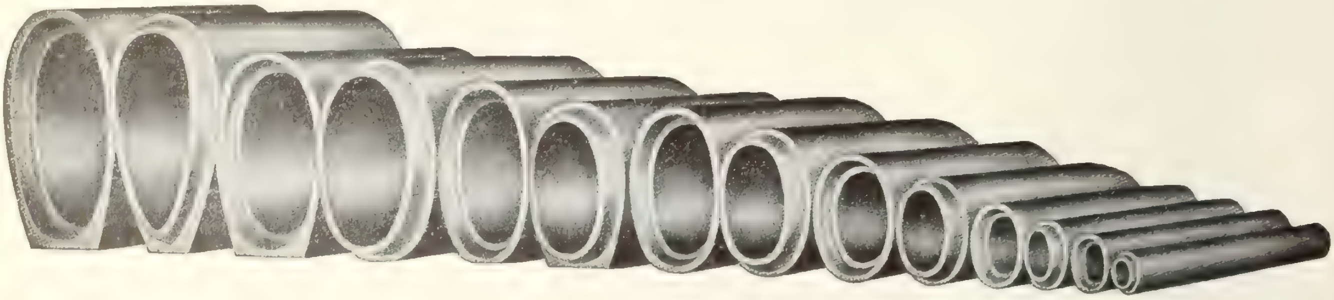

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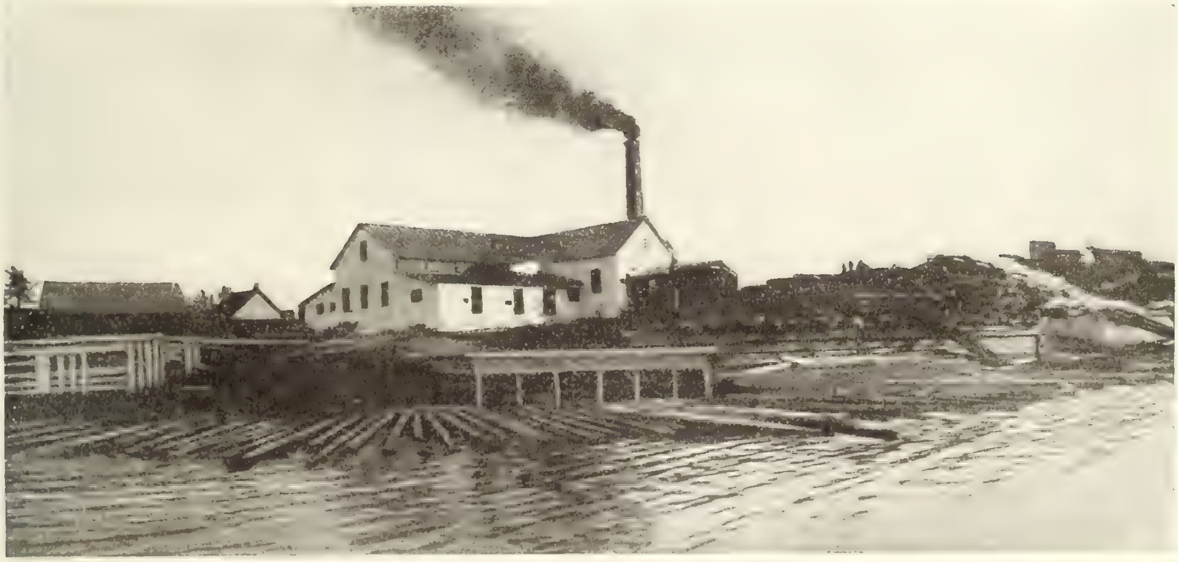

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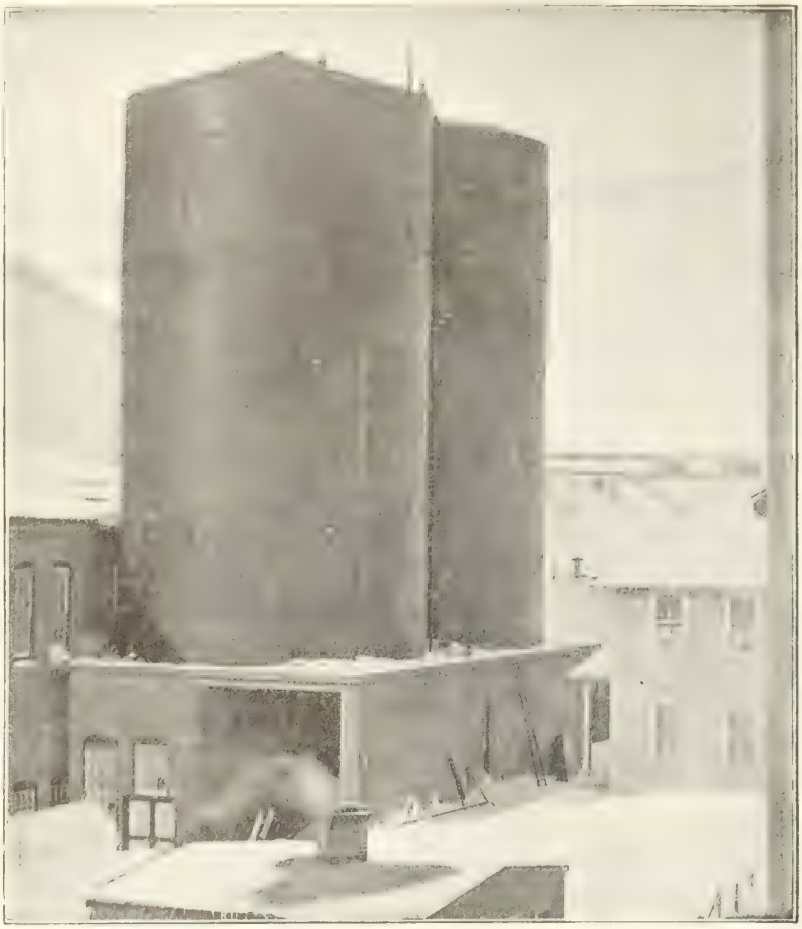

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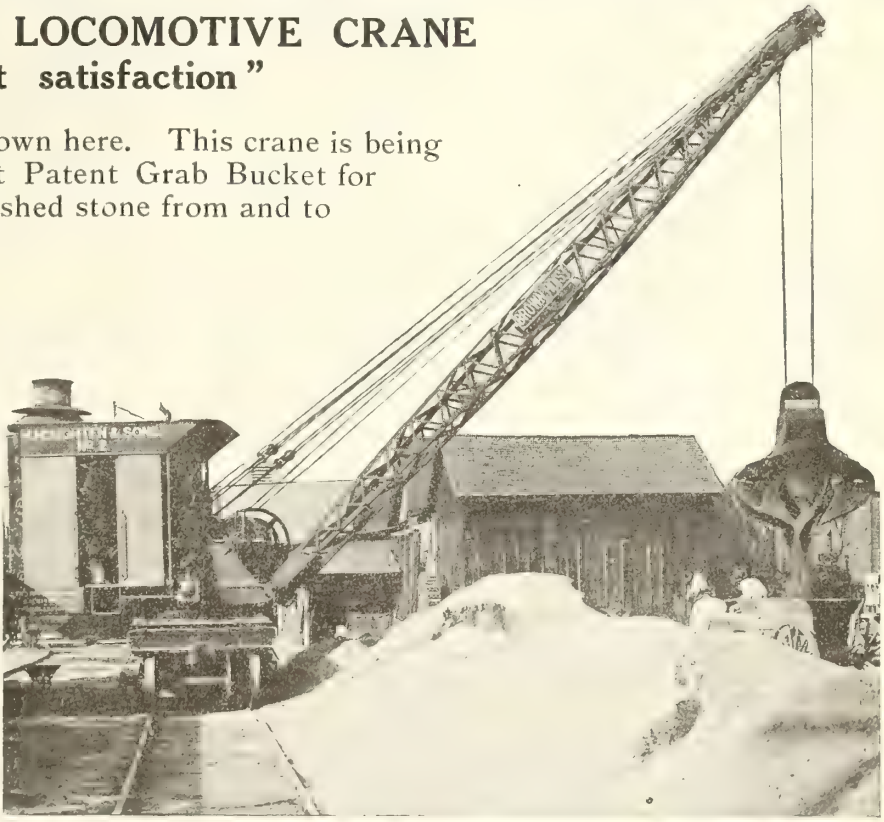

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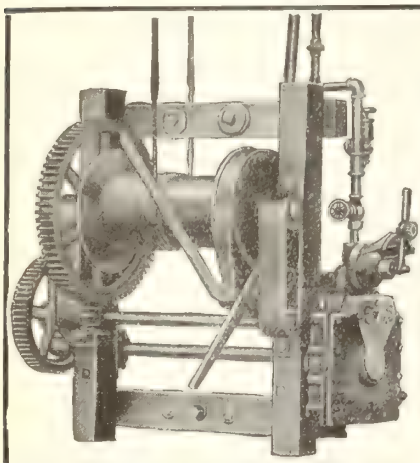

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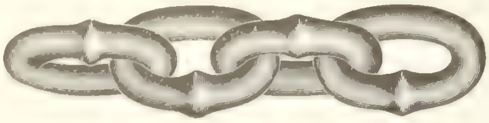

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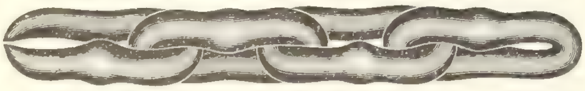

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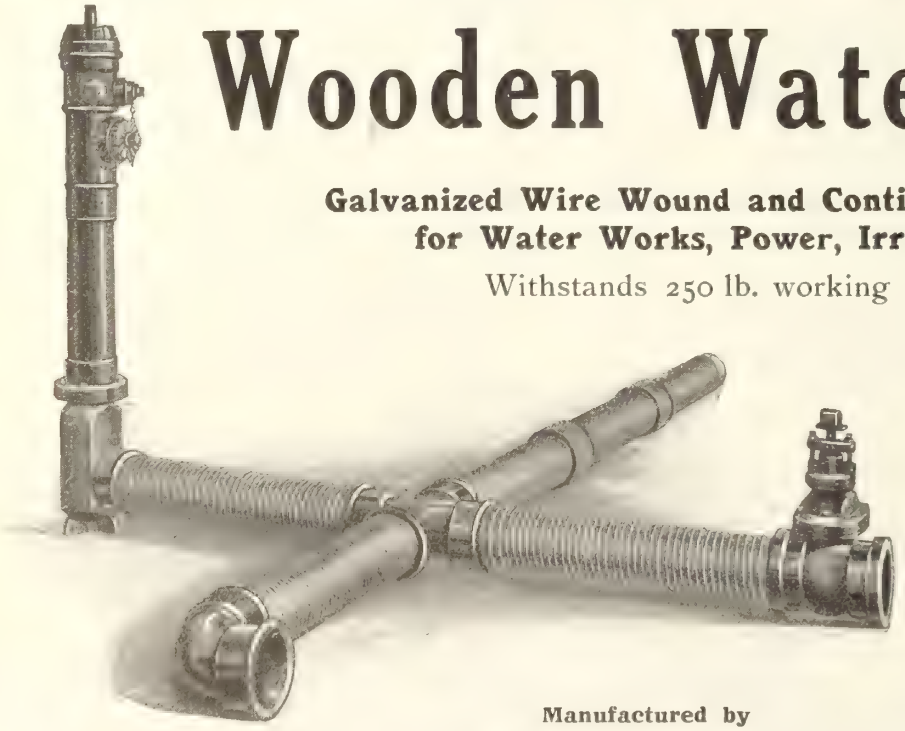

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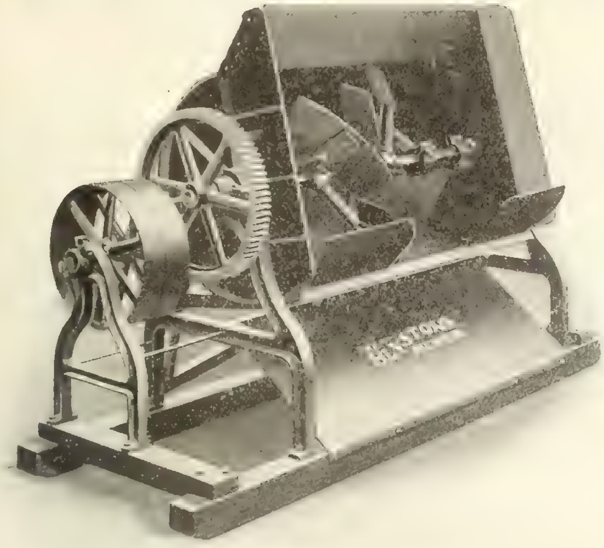
The Best Service at Lowest Cost



The Blystone Skid Mixer

The perfect design and construction of this mixer reduces the working cost to a minimum and effects the greatest ease in operation. All working parts are strongly made and will not get out of order.

Easy to work—Easy to Clean High efficiency—Low cost

SEND FOR PARTICULARS

The Blystone Machinery Company
62 Railroad St., CAMBRIDGE SPRINGS, Pa., U.S.A.

Full line of Blystone Mixers carried in stock by
The A. R. Williams Machinery Co., Limited, Toronto, Ont.
N. J. Dinnen & Co., Limited, Winnipeg, Man.
Gorman, Clancy & Grindley, Calgary, Alberta.
Ritchie Contracting & Supply Co., Vancouver, B.C.

"Metallic"

Corrugated Iron
Galvanized

Is noted for the depth of corrugation, and consequent increased strength. Our sheets are carefully zinc-coated to insure the longest weather protection.

By the careful selection of our sheets, and our process of manufacture, "Metallic" Corrugated Iron holds its depth of corrugation. Many experts specify "Metallic" Corrugated Iron, of which we can deliver a large variety of dimensions, straight or curved, promptly. We also manufacture painted Corrugated Iron.

Let us tell you why our sheets are superior for every corrugated iron purpose.

THE METALLIC ROOFING CO.
OF CANADA LIMITED,
TORONTO AND WINNIPEG

Contractors' Acetylene Flare Lights

Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa $95.00.

SIZE NO. 2—

1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

Price F.O.B. Ottawa $65.00.

Manufactured by

International Marine Signal Co. Limited
Ottawa, Canada

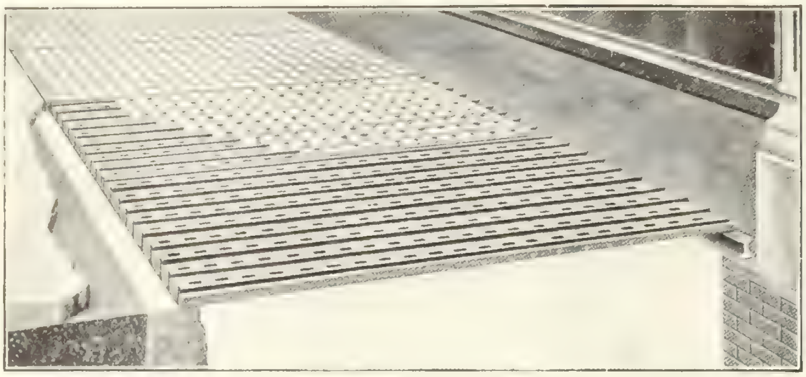
FOR SALE

1, 10 x 16 Slidevalve Engine
2, 40 H.P. Tubular Boilers
1, 10 Ton Derrick Complete
1, 30 H.P. Dick Kerr Motor
1, 40 H.P. Bullock Motor
2, 2 H.P. 2 Phase Motors
1, No. 5 Pulsometer Pump (New)
1, 1/2 Yard Milwaukee Concrete Mixer
1, 7 x 10 Blake-Marsden Crusher
1, Pair 5 Foot Edge Rolls
1, No. 3 Gates Crusher with Elevator and Screen Complete
1, 6" Morris Sand Pump Steam Connected
1, 7 x 12 Beatty Hoist with Swinger
1, No. 4 Champion Stone Crusher
1, 6 x 3 x 7 Cameron Sinker
1, Buckeye Trench Excavator

The above machines are but slightly used and are in good working order.

Fleming Machinery Company
340 Sparks Street, Ottawa, Can.

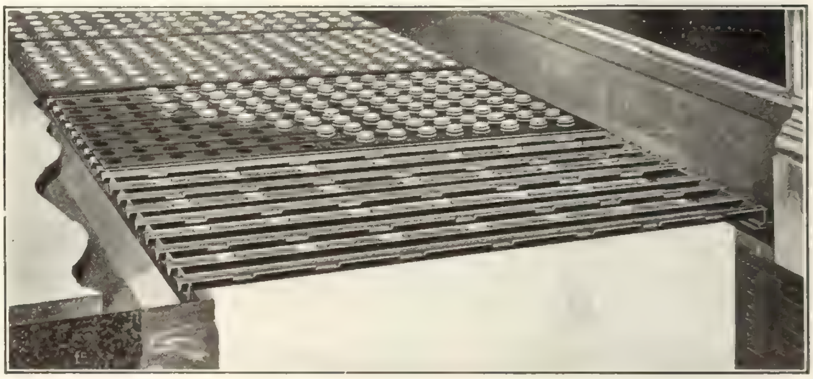
PAVEMENT SIDEWALK GLASS



If you are interested in Sidewalk Prism Constructions that are guaranteed against leakage, write for particulars regarding these.

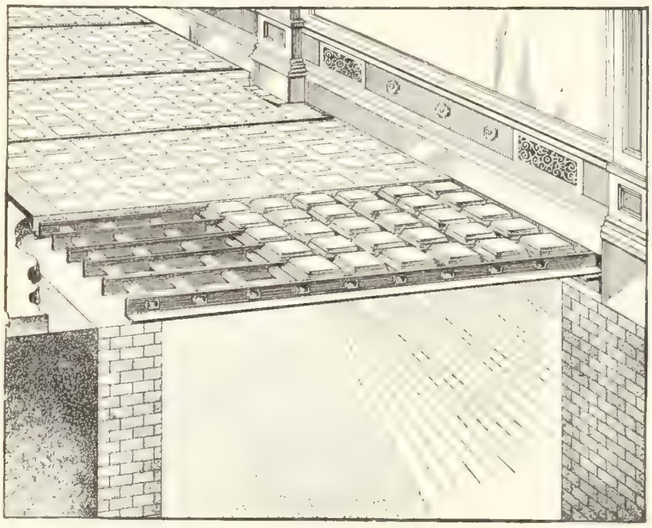
Simplex Sidewalk Construction

is the only double reinforced construction on the market and is the acme of perfection in sidewalk lighting. Architects and owners who understand and appreciate the advantages of SIMPLEX willingly pay the additional price for this construction.



Nu-Plan Sidewalk Construction

is shipped in knock-down form and is exceptionally easy to set up and can be installed by an ordinary cement finisher. This construction derives its enormous strength from the use of angles instead of bars.



Barlock Sidewalk Construction

has stood the test of years and installations of many years ago are still in good condition. The glass area of approximately 70 per cent. on the underside of this construction gives you the assurance of the maximum amount of lighting.

All of the Above Constructions Are Covered by Canadian Patents

With any of the above we can furnish glass to suit the requirements of the basement or other part of the building to which light is required to be reflected.

We can supply the blank glass, the 3-point prism glass and the single pendant prism glass.

All glass sent out by us is coated with our patented plastic malleable compound, which insures glass from shaling from exposure of the cement or steel.

THE HOBBS MANUFACTURING COMPANY, LIMITED

MONTREAL TORONTO LONDON WINNIPEG VANCOUVER

SIX REASONS

which account for the superiority of

Creosoted Wood Block Pavements

Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

Its Ease of Repair; No difficulty being experienced in removing and replacing the blocks; no expensive plant or skilled workmen required.

Its Sanitary Qualities; Creosote being a highly antiseptic and waterproofing material instantly destroys all germs, prevents the absorption of street filth and consequent decay.

Its Noiselessness; The rattle and bang of vehicles passing over its smooth surface absorbed and muffled till the quiet of the dirt road is obtained.

Its Dustlessness; Does not pulverize; the heaviest traffic only pounding down the wood fibres to offer the greater resistance.

Its Cleanliness; Having a smooth surface and being waterproof it does not differ in this respect from asphalt.

We manufacture blocks of the highest possible standard, the very best materials only being used and in the Dominion Wood Blocks we believe we produce an article that has no equal.

The Dominion Creosoting
Company, Limited
Vancouver, B. C.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound. 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.

Sole Licencees for Canada

613 Vancouver Block,
VANCOUVER
B. C.

Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.

Trinidad Lake Asphalt

With this material 175,000,000 square yards of smooth, durable streets have been constructed during the last 35 years. Trinidad sheet asphalt is the "world's highest paving standard." Its record for service is unmatched; its first cost is less than that of other pavements of anything like the advantages of sheet asphalt. In view of these facts, why experiment with materials of unknown or known-to-be-inferior qualities?

The Barber Asphalt Paving Co.
Philadelphia, Pa.

THIS CAR LOADED WITH
BAY STATE BRICK – CEMENT COATING
FOR THE
WAITE FULLERTON CO. LIMITED
WINNIPEG MANITOBA – CALGARY ALBERTA
MADE BY
WADSWORTH HOWLAND & CO INC
BOSTON MASS

A Carload of

Bay State Brick and Cement Coating

going to Winnipeg, Manitoba

Thousands and thousands of gallons of this coating are being used as a protection for cement, brick and stucco in the Canadian Northwest.

It insures concrete, cement and stucco against disintegration from moisture and does not destroy the pleasing effect of concrete.

It is used in mills, hotels, residences, railroad construction, or bridges, or wherever concrete, cement or stucco is employed.

For Booklet M for full particulars, address

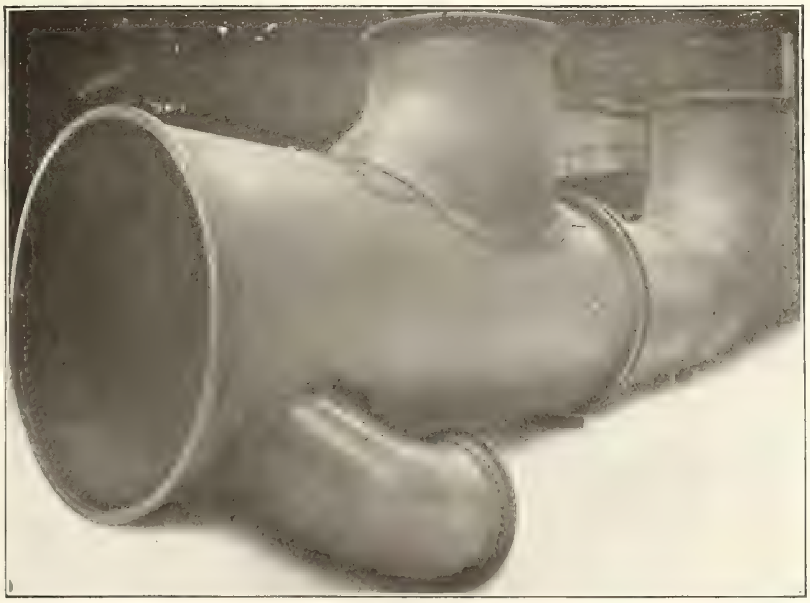
Wadsworth, Howland & Co., Inc.

Paint & Varnish Makers & Lead Corroders
82-84 Washington St., Boston, Mass.
N.Y. Office, 101 Park Ave. at 40th St.

Canadian Representatives:—Gouinlock & Crawford, 217 Confed. Life Bldg., Toronto, Can.; David McGill, 83 Bleury St., Montreal, Can.; Waite-Fullerton Co., Winnipeg, Calgary, Edmonton and Regina.

Water Turbine Installations

Seamless *Steel* Tubes up to 12 inches diameter



Lap-welded *Steel* Tubes from 12 inches upwards

Distributing Pipe for The Ontario Power Co.
Length 32′ 6″ Niagara Falls Height 12′ 2″

MANNESMANN TUBE CO., Limited, Montreal
51 Victoria Square

JACKS

For Every Lifting Purpose

"The Jacks that Duff Builds" are designed to give perfect satisfaction, and are noted for their durability, reliability, and easy, convenient operation.

Genuine BARRETT Track Jacks
Genuine BARRETT Automatic Lowering Jacks
DUFF Ball-Bearing Screw Jacks
DUFF-BETHLEHEM Forged Steel Hydraulic Jacks

Capacities from 1,500 lbs. to 500 tons and a wide variety of styles and heights, insures the selection of the proper jack for any requirement.

Ask for Catalog No. 15 *Sole Agents for Canada*

The Canadian Fairbanks-Morse Co., Limited

MONTREAL OTTAWA ST. JOHN TORONTO WINNIPEG
CALGARY SASKATOON VANCOUVER VICTORIA

3

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Sixth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

Parliament Buildings, Edmonton

This building was wired with
"Adanac" Rubber Insulated Wire

Architect: A. M. Jeffers, Edmonton.
Engineer: James McAlear, Chicago.
Electrical Contractors: Cunningham Electric Co., Calgary.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd. Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"

Lap Welded Steel Pipe

We carry in stock
30 INCH DIAMETER
LAP WELDED STEEL PIPE

Ask for Prices

International Marine Signal Co. Limited
Ottawa, Canada

The Des Moines Hemispherical Bottom Steel Tanks and Towers
have been used and approved by nearly all leading Engineers. They are undoubtedly the most economical means of storing water at an elevation.
We have built many of these in Canada, the United States and Mexico. Estimates cheerfully furnished.

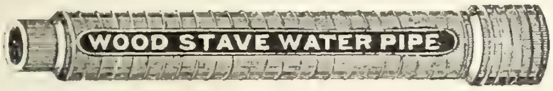
Send for Catalog No. 15

'Engineers desiring one of our Tank Calculators will receive same upon application."

Des Moines Bridge & Iron Co.
Pittsburg, Pa., U.S.A., 945 Curry Bldg.
Des Moines, Iowa, U.S.A. 938 Tuttle St.
F. H. Hopkins & Company, Canadian Representatives, Montreal, Quebec.

STEEL WORK WHEN YOU WANT IT
STANDARD STEEL CONSTRUCTION CO.
Limited
WELLAND - CANADA
MANUFACTURERS AND ERECTORS
Girders, Columns, Trusses, Etc.
STEEL BUILDINGS AND BRIDGES
Bars, Angles, Plates, Beams, Channels
always in stock for immediate shipment.

THE DOMINION WOOD PIPE COMPANY
LIMITED
NEW WESTMINSTER, B.C.
MANUFACTURERS OF
DOUBLE WIRE WOUND



AND
CAST IRON SPECIALS, VALVES, HYDRANTS, ETC.

KAHN SYSTEM
OF REINFORCED CONCRETE

Steel Sash
Hyrib, Rib Bars,
Rib Metal.

Concrete
Finishes
Waterproofing
Paste

KAHN SYSTEM
Reinforced Concrete

Trussed Concrete Steel Co. of Canada, Limited
Head Office and Works
WALKERVILLE, Ont.
Branches everywhere

Sarnia Bridge Company Limited
SARNIA - CANADA
WE ARE MANUFACTURERS OF
Structural Steel of All Kinds

Railway and Highway Bridges
Steel Buildings

Beams, Channels, Angles, Plates,
etc., in stock

ESTIMATES AND DESIGNS FURNISHED ON APPLICATION

"BEATTY" HOISTS

Contractors who buy numbers of Hoists usually have to be convinced that what they are getting is "O. K."

The closer they examine and watch BEATTY HOISTS under severest conditions — the better pleased they are.

Their use spells SATISFACTION.

The reason? The material, design and workmanship "are there."

We are building for the future—both yours and our own.

If you place one BEATTY HOIST on your work, you'll eventually buy more.

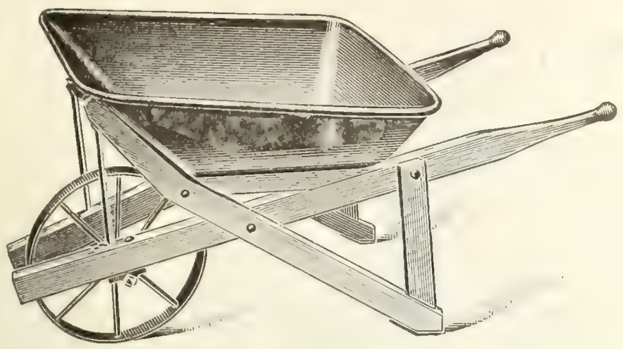
Will gladly send full particulars and catalog.

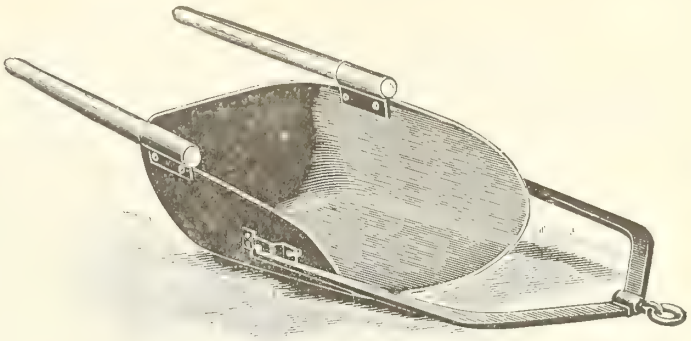
DIPPER DREDGES
CLAMSHELL BUCKETS
STEEL DERRICKS
CLAMSHELL DREDGES
PILE DRIVERS
DERRICK IRONS
STEEL SCOWS
CENTRIFUGAL PUMPS

M. BEATTY & SONS, LIMITED

WELLAND, ONTARIO

H. E. Plant, 1790 St. James St., Montreal
Robt. Hamilton, Vancouver, B. C.
H. W. Petrie, Limited, Toronto.
E. Leonard & Sons, St. John, N. B.
E. Leonard & Sons, Calgary, Alta.
All carry our equipment in stock.



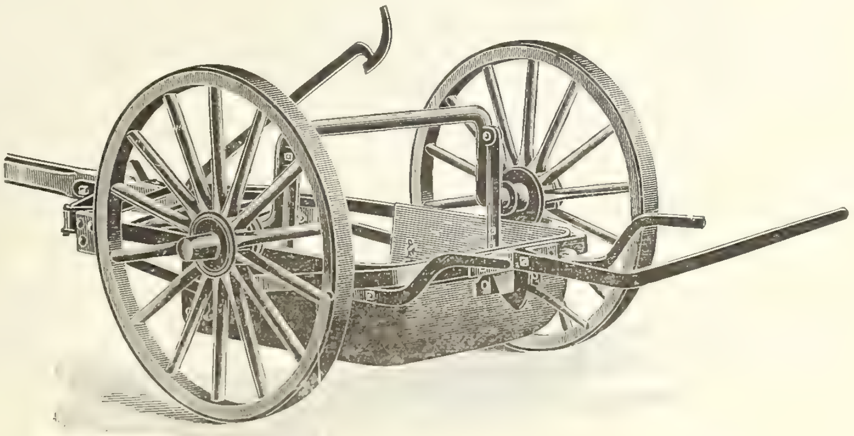


IRON AGE
Steel Tray Barrow

This barrow is made specially for the contractor and concrete work. It is unusually strong and thoroughly braced. The tray is pressed from a solid sheet of high carbon steel and has no joints or seams.

IRON AGE
Drag Scraper

The drag scraper is also pressed from high carbon steel sheets. It is very stiff and will "make good" in the roughest kind of excavating or leveling work. The handles, etc., are heavily rivetted to the bowl.

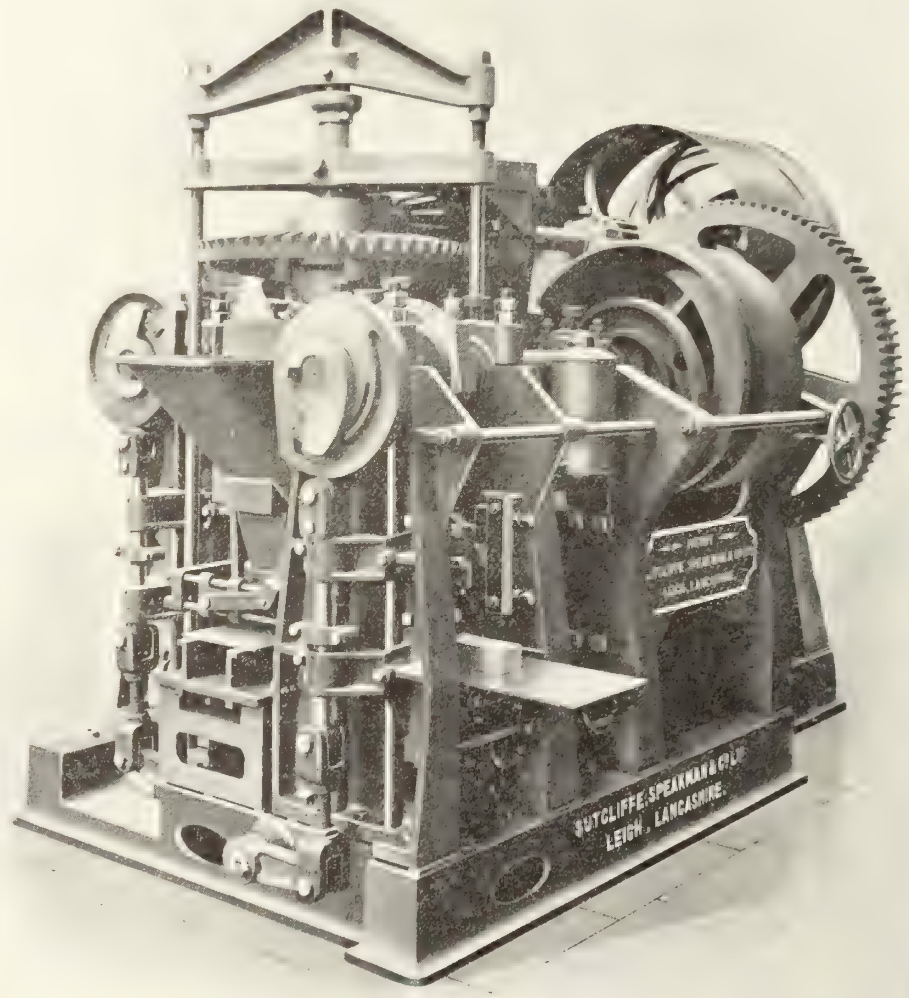


We also make wheel scrapers and a complete line of pick and rooter plows. Road contractors will find the "Iron Age" line able to stand the hardest tests.

Send for the "Iron Age" catalogue.

The Bateman-Wilkinson Co., Limited

340 Campbell Ave. - Toronto



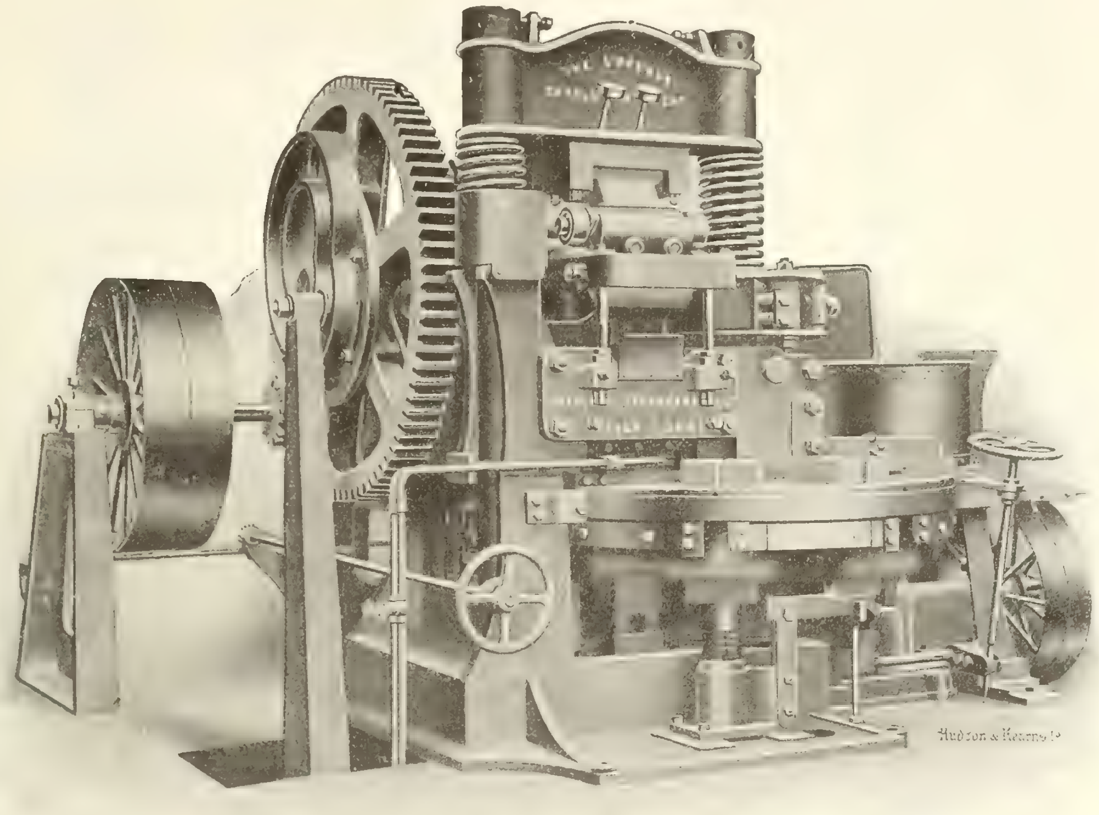
The Plastic Brick Press

Capacity 30,000 to 40,000 per day

Makes bricks with auger which go direct to kiln without drying.

Sutcliffe, Speakman & Co., Limited

Leigh, Lancashire, England



The Duplex

"Emperor" Press

(Sutcliffe's Patent)

For Sand-Lime Bricks

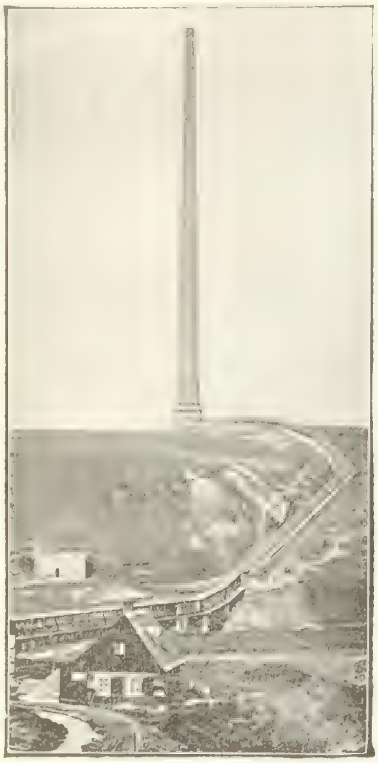
OVER 100 IN OPERATION

Exerts a pressure of 200 tons.
Weight: 35,000 lbs.

Capacity: 2,000 to 2,600 bricks per hour.
Actual Horse Power: 12.

Sutcliffe, Speakman & Co., Limited

Leigh, Lancashire, England



460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

Write for catalogue

H. R. HEINICKE, INC. New York, U. S. A.

Representatives for Canada:
Black Building Supply Co., Ltd. Toronto
Dartnell Ltd., Montreal, Que.

BUILDERS' SUPPLIES

- Lime
- Portland Cement
- White Cement
- Keenes Cement
- Plaster Paris
- Hard Wall Plaster
- Mortar Colors
- Fire Brick
- Sewer Pipe
- Weeping Tile
- Sacketts Plaster Board
- Parkers Corner Bead
- Rubble Stone
- Crushed Stone, Etc.

With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

Ontario Lime Company

Limited

Crown Office Building, Toronto, Ont.
Head Office Phones: Main 5472—5473

The

Kon-Wald System

of

Steel Coal Elevators

will

Increase Your Profits

and

Decrease Your Labor

Write Now for
Information and Estimates

Kon-Wald Engineering Co.

Mutual Life Building, BUFFALO, N. Y.

The

Canada Sand Lime Pressed Brick Company Limited

Works at - West Toronto

and

Halton Brick Company Limited

Works at - Terra Cotta

Both under the same management.

Pres.—W. M. Flavelle, Lindsay.
Vice-Pres.—John Carew, Lindsay.
Secy. and Mgr.—Robert Kennedy, Toronto.
Sales Mgr.—David Kennedy, Toronto.

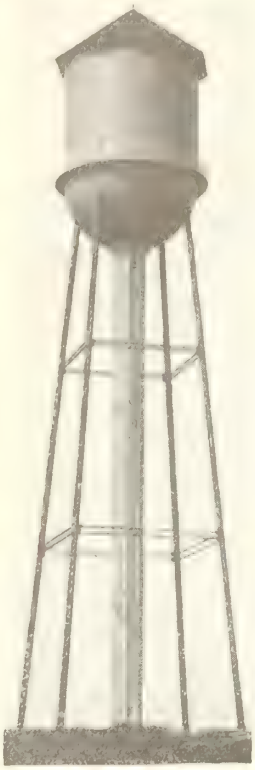
Head Office - 1661 Dundas St., Toronto

We are the first manufacturers of Sand Lime Brick in Toronto, having been established in 1905.

We operate the most successful plant in Canada.

We also manufacture First Class Pressed Clay Brick at moderate prices.

Our Motto—Fairness, Promptness and Satisfaction



Built for City of Wetaskiwin, Sask., City Waterworks.

Canadian Plant

Chicago Bridge & Iron Works

BRIDGEBURG, ONT.

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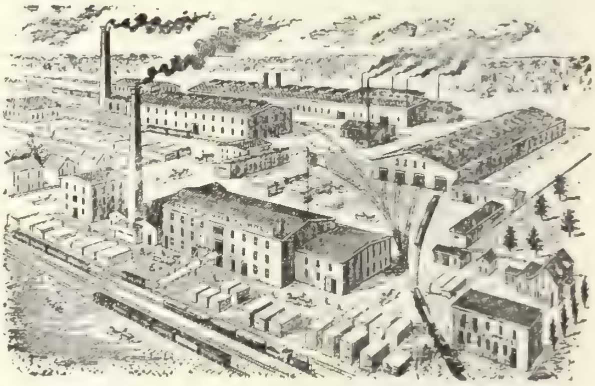

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We manufacture all kinds of building materials, including cast iron columns, cresting, sash weights, etc.

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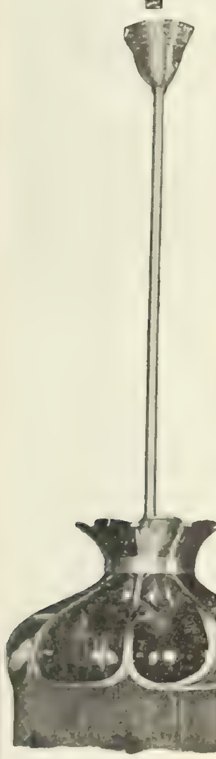

Beautiful Gas Fixtures

For the Modern Home

The fixture shown here gives some idea of the styles now being made up in gas fixtures. We had always believed that there was an undeveloped market for a very much higher grade of gas fixture than the ones usually supplied by gas companies throughout the country; and realizing too that our customers' interests were identical with our own, we set about arousing the interest of several fixture manufacturers, who have designed and made for us entirely new lines of fixtures, so that our salesroom is now equipped throughout with fixtures which, in quality of design, finish and effect, cannot, we believe, be surpassed by any lighting fixtures on the market today. Gas light is the whitest of all artificial illuminants. It is the most efficient per candle power, therefore the most economical. The use of gas in fixtures as shown here insures a display absolutely unattainable with any other illuminant. Artistic illumination is the crowning glory of the beautiful home. We have fixtures to suit every requirement and to fit every purse.

The Consumers' Gas Co.

12-14 Adelaide St. West Telephone Main 1933

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Elk Fire Brick Co.
of Canada
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Federal Life Building
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Manufacturers of

HIGH GRADE FIRE BRICK AND CLAY

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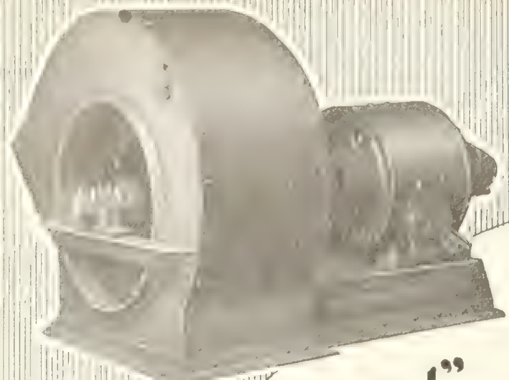
Philadelphia Brick Machine Works

GEORGE CARNELL, Machinist and Engineer

1817 to 1823 N. Fifth St., PHILADELPHIA, Pa., U.S.A.

. . . Manufacturer of . . .

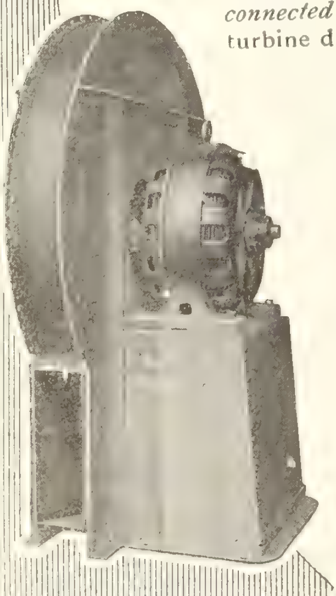
Brick Machines, Stamping Machines, Brick Presses, Tile Machines, Clay Tempering Machines, Pug Mills, Wheel Barrows, Shafting, Pulleys, Kiln Castings; and keep a full line of all articles used around a brick plant.



"Buffalo" Fans

For Heating, Ventilating, Drying and Exhausting.

Ask our engineers to recommend the fan best suited to your requirements. Our designs include the new high-efficiency "*Conoidal*" multiblade fan, used extensively for heating systems, mine and tunnel ventilation, and the motor-driven *Steel Plate Pressure Blower*, giving pressures up to 24 oz. Both of these designs show higher efficiency than obtained with any similar types. We specialize in *direct-connected* units (motor, engine or turbine driven) for every service. These are distinguished by absence of belt troubles and the very lowest power consumption. Whatever your problem write us.



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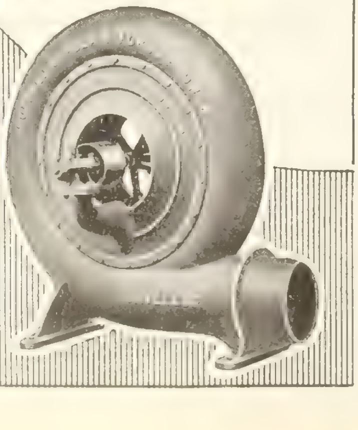

Protect Your Buildings As Well as Insure Them!

Prevention of fires is vastly better than the partial redress which is all the best Fire Insurance Policy can give you. This prevention is easily secured by using

Asbestocement Building Materials

TRADE MARK
ASBESTOSLATE
ASBESTOS SHINGLES

make roofs that are handsome, *fireproof*, practically everlasting and moderate in price.

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prevents inside fires from spreading. It is quickly applied, and gives a permanent, attractive, yet inexpensive interior finish.

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makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely ***weather and fire proof.***

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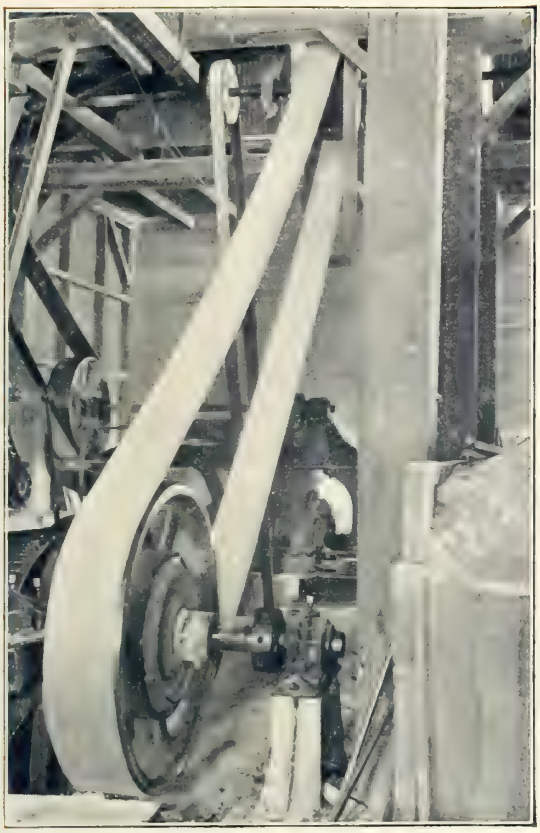


YOU will find all the largest *Brick Plants* in Canada using our belts for both transmission and conveying, and our customers invariably come back for more.

There must be a reason

SCANDINAVIA BELTING

Scandinavia Belting will stand the test and tear of a Brick Plant. It is not made in plies, but is solid woven, hence no plies to come apart. It is strong and has a good surface for gripping the Pulleys.

Its surface will also resist wear when using for conveying, and it will wear down like any solid Belt.

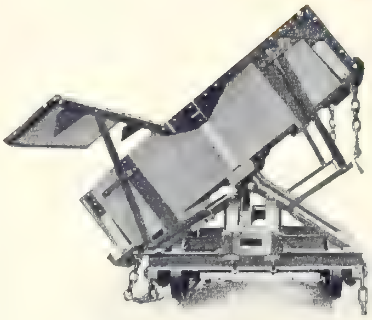
If you want a good Belt for use in a wet place use

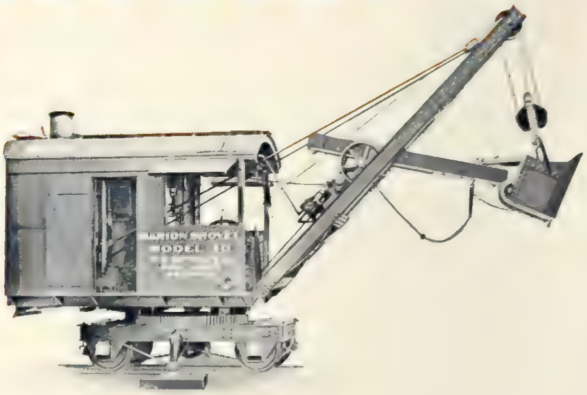
BELTING

Federal Engineering Company, Limited

TORONTO MONTREAL

Brickyard Equipment





"Marion" Steam Shovels — Dump Cars
Locomotives — Steel Rails
Scrapers — Wheelbarrows — Cables

Suitable for

Brickyards, Quarries, Mines, Etc.

We furnish Dump Cars in all sizes, suitable for any practical gauge track.
These Dump Cars are well built and will withstand very severe service.
Cars supplied with either wood or steel frame.
Full particulars sent upon request.

Gasoline or Steam Locomotives, designed specially for use in Brickyards, etc. It will pay you to secure our specifications and prices.

All sizes and styles of Marion Steam Shovels. We have special shovels for use around Quarries, Mines, etc. Our Model 28 Revolving Shovel is especially adapted for Brickyards.

Let us send you our Booklet—"Photo Talks"

F. H. Hopkins & Co.

MONTREAL

BRANCHES AT WINNIPEG AND VANCOUVER

Vol. 27 Toronto, December 17, 1913 No. 51

ESTABLISHED 1886

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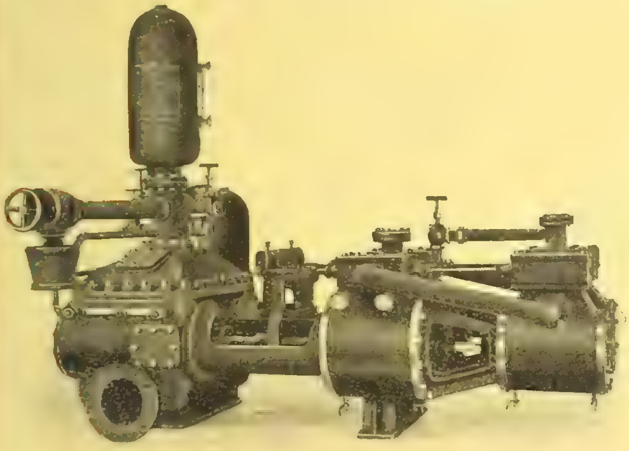
"A FRIEND IN NEED"
A Smart-Turner specially designed Fire Pump you will find to be a friend indeed.



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Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

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OF BELLISS MAKE
have gained their reputation for

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Continuous and Machine Banded Wood Stave
WATER PIPE
RESERVOIR TANKS
for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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Full Particulars and Estimates Furnished

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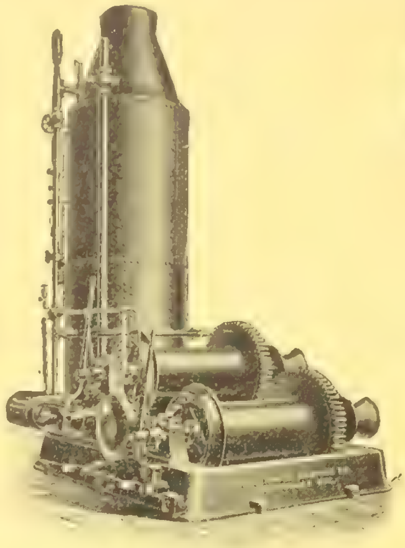
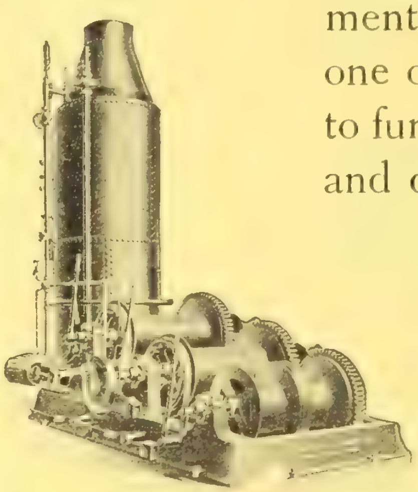


Hoisting Engines

With Single or Multiple Drums

¶ We build a wide range of these engines to meet every requirement of contracting work. Any one of our offices will be glad to furnish full particulars, prices and deliveries.



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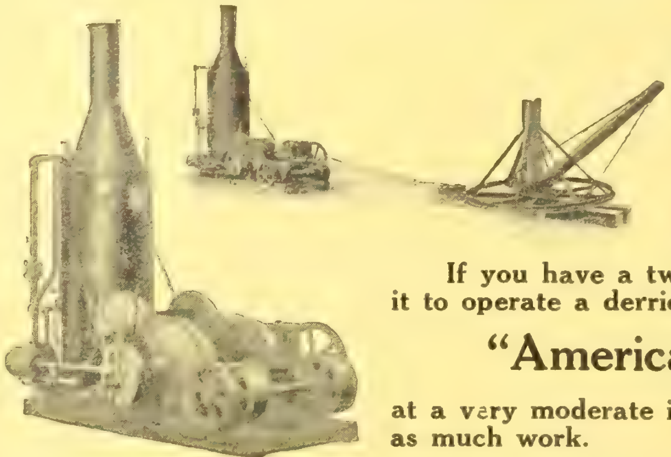

Increase the Efficiency of Your Engine Four-Fold

If you have a two drum "AMERICAN" Engine and wish to equip it to operate a derrick with bull wheel you can get

"American" Slewing Attachment

at a very moderate investment. It will enable you to do four times as much work.

This slewing attachment consists of two individual drums with brackets and driving mechanism, mounted on oak skids. The two drums have a vast advantage over all single drum devices. They keep the bull wheel lines separated about five feet, preventing them from snarling or fouling the main hoisting lines.

The operation is very simple; the movement of a single lever causes the drum to revolve in either direction; slewing starts and stops smoothly, eliminating undue strains. Slewing drums operate in entire independence of the hoisting drums, and they require no attention when once started.

Safe, speedy, slewing is most desirable and can go a long way toward reducing the time required to finish a job; not to speak of eliminating undue strains upon derrick members.

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American Hoist & Derrick Company

ST. PAUL, MINN., U. S. A.

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Others, more careful, say they want "Portland Cement"—

But the man who does the best work insists upon getting "Canada" Portland Cement—

And he looks to see that every bag bears this label

CANADA CEMENT COMPANY LIMITED
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CANADA
CEMENT
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TO specify Canada Portland Cement is to introduce an additional safety factor into your calculations. Architects, contractors and engineers know the value of "making assurance doubly sure."

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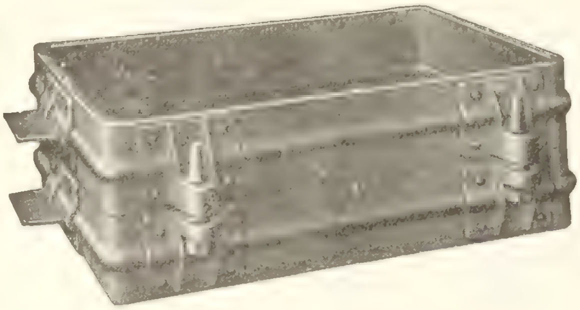
STERLING

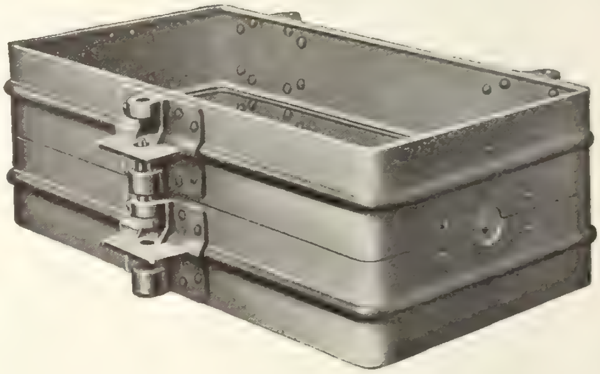
ROLLED STEEL

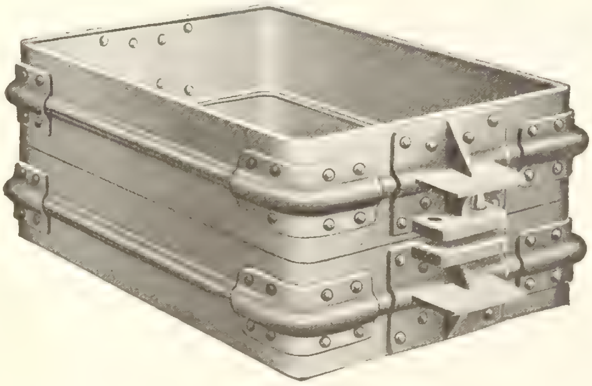
FLASKS

For Bench, Machine and Floor Moulding, Will Stand the Wear and Tear.



Do you use the old fashioned wood flasks? or the cast flasks? The former burn, are expensive, heavy and difficult to handle. The latter break easily, needing constant repairs and replacement.





The **"Sterling"** will not burn, break or spring. They combine lightness and durability.

Various styles, shapes and sizes.

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The

Reading Multiple Gear Chain Block

Will Do Your Hoisting Most Efficiently.

With a Reading one man can do as much work as two men with a screw block or three men with a differential block.

The Reading is the only chain block whose entire working parts are enclosed in a dust-proof casing and operate in a bath of oil.

Works in any position and in all kinds of weather.

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  - Improved Equipment Co.
- **Gasoline Engines**
  - Wettlaufer Bros.
- **Gas Plants Complete**
  - Improved Equipment Co.
- **Gas Producers for Heating**
  - Improved Equipment Co.
- **Gas Machinery**
  - Improved Equipment Co.
- **Glass**
  - Consolidated Glass Co.
  - Hobbs Mfg. Co.
  - Luxfer Prism Co.
  - Toronto Plate Glass Imp't'g Co.
- **Gravel Washing Plants**
  - Dull Co., Raymond W.
- **Hammer Drills**
  - Canadian Ingersoll-Rand Co.
- **Heating Apparatus**
  - Canadian Buffalo Forge Co.
  - Canadian Sirocco Co.
  - Sheldons Limited
- **High Pressure Pipe Lines**
  - Boving Company of Canada
  - Escher Wyss & Co.
  - Pittsburgh Valve, Foundry & Construction Company
- **Hoisting Apparatus**
  - American Hoist & Derrick Co.
  - Beatty & Sons, M.
  - Browning Engineering Co.
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Fairbanks-Morse Co.
  - Canadian Ingersoll-Rand Co.
  - Jenckes Machine Co.
  - Hopkins & Co., F. H.
  - Lecky & Collis
  - Marsh & Henthorn
  - Mussens Limited
  - Royce Limited
  - Sturtevant Co. of Can. Ltd., B. F.
- **Hoisting Engines**
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Fairbanks-Morse Co.
  - Wettlaufer Bros.
- **Hydrants**
  - Canada Iron Corporation
  - Gartshore-Thomson Pipe Co.
  - Kerr Engine Company

(Continued on page 10)

The New
Royal Bank
Building,
Toronto,
To be
Fireproofed
Throughout
With
Don Valley
Porous
Terra Cotta
Fireproofing

The Largest Contract For Porous Terra Cotta Fireproofing

The largest contract ever placed for one building in the British Empire has been made for

Don Valley Porous Terra Cotta Fireproofing

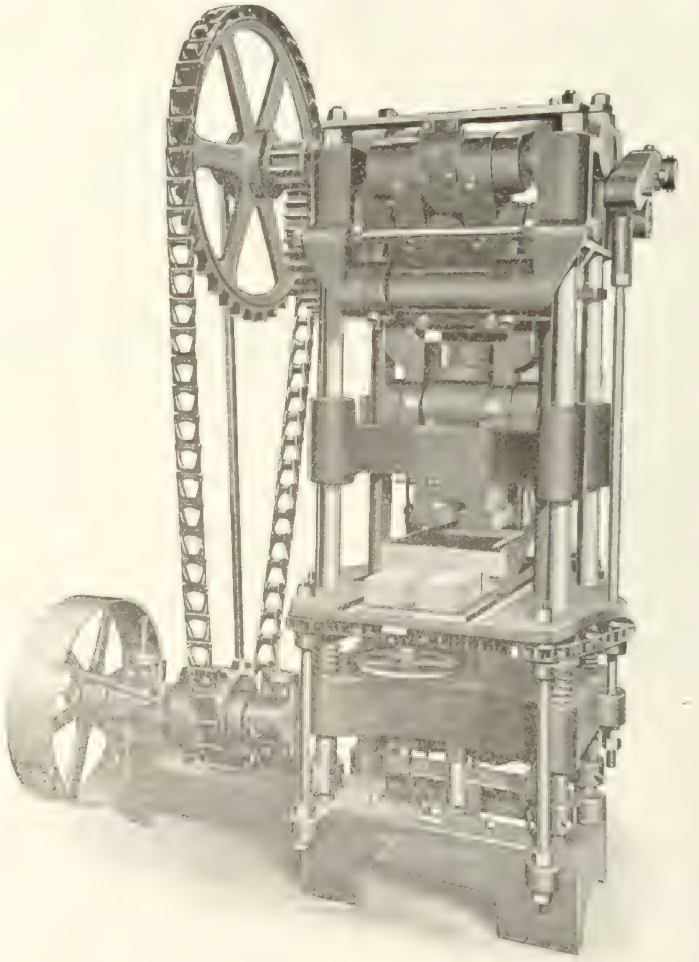
to be used in fireproofing the Royal Bank Building, Toronto.

Don Valley Brick Works

Toronto, Ont.

THE WETTLAUFER

BRICK PRESS



The Wettlaufer Brick Press covers a wide range of work in the manufacture of Cement, Lime and Clay Brick. A new feature of this machine is the Double Repress which renders impossible any voids in the finished brick. Manufactures bricks any size between 1 in. and 3½ in. in thickness. The capacity of the machine is 15,000 per ten hours, the power required to run the press being from 4 to 5 H. P. It will be to your advantage to attend the daily demonstration at one of our branches.

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L Lachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagauchetiere St. W., Montreal.

Rogers' Portland Cement

AND CRUSHED STONE

Concrete Arch Bridge of Embro, Ont., built with Rogers' Cement

C. E. URE, Woodstock, ENGINEER **BAIN & ROSS, Embro, CONTRACTORS**

Cost price $4,200. Length of span 75 ft. Total length of bridge, including wings, 120 ft. Ten tons twisted bars used in reinforcment.

Rogers' cement is the most dependable for all types of construction and engineering-contracting work—especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, etc.

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

CRUSHED STONE

Our crushed stone is free from dust, dirt and mold—it is really clean stone—properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

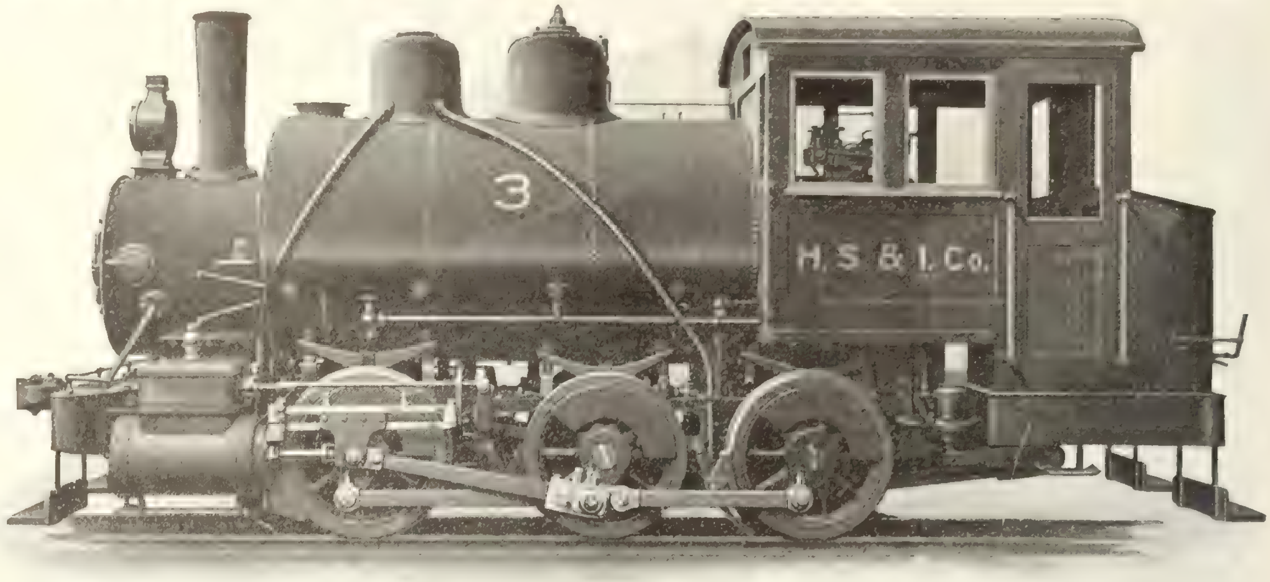
Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

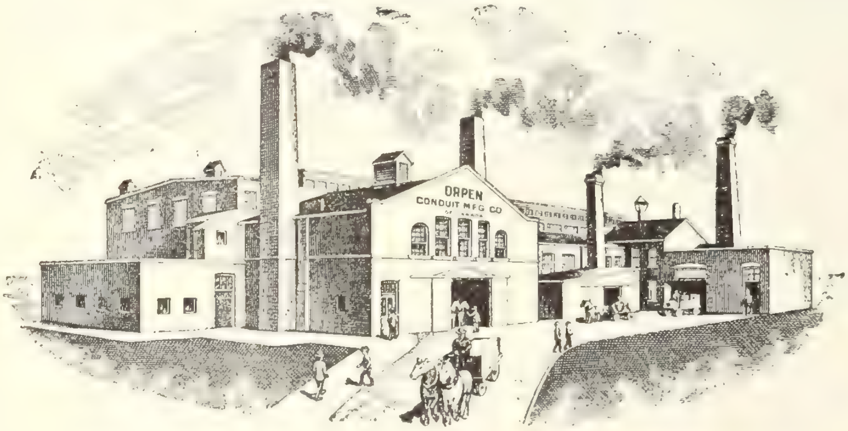
CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA



ORPEN CONDUIT MANUFACTURING Co. of CANADA
MANUFACTURERS
XCELADUCT
AND
ORPENITE
CONDUITS
HEAD OFFICE
TORONTO ONTARIO

The Sign of Good Conduit

"Xceladuct" and "Orpenite" Conduit

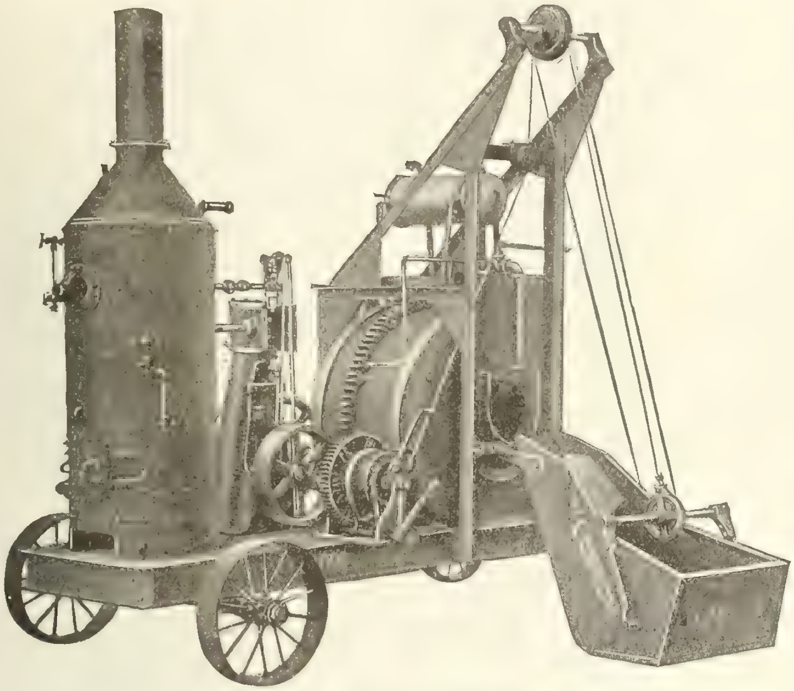
"Xceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

"Orpenite" Enameled Conduit—Easy Bending Spellarized Steel Tube; protected against rust by coatings of special enamel not affected by temperature conditions, smooth interior.

We solicit an opportunity to submit prices and other particulars.

Orpen Conduit Manufacturing Co. of Canada
TORONTO, CANADA Montreal, Quebec

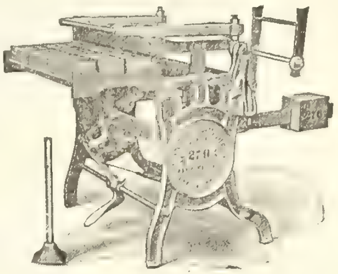
HAVE YOU SEEN OUR 180 PAGE CATALOGUE?



London Standard Drum Batch Mixer

Showing the largest line of Concrete Machinery ever crammed into a Catalogue.

All made in our own Factory and under a system producing an excellence of quality. Our large output right from Factory to the Contractor.

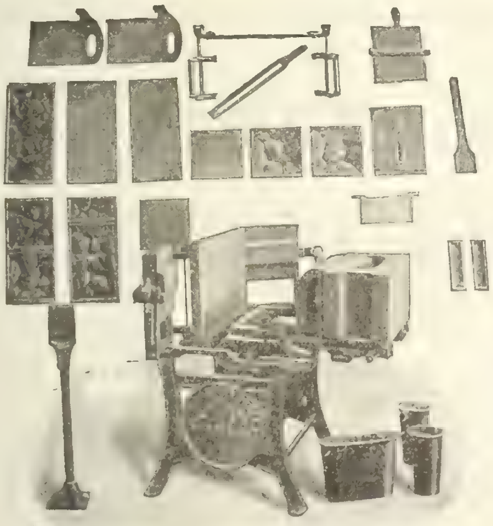


London Cement Brick Machine.

Even such remarkably low prices are preferable to exorbitant prices and small output.

Some people wonder how we can sell high grade machinery at such low prices. **It is quite simple. Our Enormous Sales and Small Profits are sufficient explanation.**

We manufacture over twenty different sizes and styles of **Concrete Mixers, Mortar Mixers, Concrete Block Machines, Cement Brick Machines, Cement Tile Machines, Tile Moulds, Rock Crushers, Screens and Elevators.**



London Cement Block Machine.

Gasoline Engines

Pumping Outfits

Steam and Gasoline Hoists

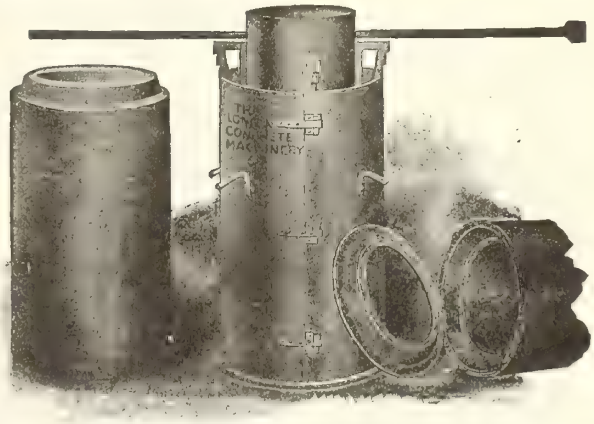
Material Elevators

Sidewalk Forms

Sidewalk Tile Machines

Concrete Carts

Wheel Barrows



London Sewer Pipe and Tile Moulds.

Sill, Step and Widow-Cap Moulds

A Complete Line of Cement Working Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:

WINNIPEG (445 Main St.) W. H. Rosevear, Mgr.

CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.

TORONTO (60 Richmond St. E.) F. D. Emsley, Mgr.

AGENCIES:

VANCOUVER, B. C. Equipment Co.

MOOSE JAW, Sask. Bridge & Iron Co., Ltd.

REGINA, H. A. Knight

FORT WILLIAM, Northern Eng. & Supply Co.

MONTREAL, Foss & Hill Mach. Co.

QUEBEC, A. D. Masson

We are the Largest Manufacturers of Concrete Machinery in Canada.

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- **Insulating Compounds**
  - Standard Underground Cable Co. of Canada, Limited
- **Interior Finish and Doors**
  - Batts Limited
  - Canada Office & School Fur. Co.
  - Rhodes Curry & Co.
- **Kilns**
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  - Sheldons Limited
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  - Goheen Mfg. Co.
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  - Canadian Pipe Co.
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  - Dominion Wood Pipe Co.
  - Gartshore-Thomson Pipe Co.
  - Munderloh & Co.
  - National Iron Works
  - National Pipe & Foundry Co.
  - Pacific Coast Pipe Co.
  - Piggott & Co., Thos.
  - Walsh Plate & Structural Works.
- **Pile Driving Machinery**
  - American Hoist & Derrick Co.
  - Browning Engineering Co.
  - Canadian Ingersoll-Rand Co.
  - Lecky & Collis
- **Pipe Fittings and Flanges**
  - Pittsburgh Valve, Foundry & Construction Company
- **Planing Mill Exhausters**
  - Canadian Buffalo Forge Co.
  - Sheldons Limited
  - Canadian Sirocco Co.
- **Plug Drillers**
  - Canadian Ingersoll-Rand Co.
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  - Alabastine Hardmortar Co.
  - Albert Mfg. Company
  - Britnell & Company
  - Ontario Lime Co., Ltd.
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  - Mueller Mfg. Co., H.
- **Plumbing**
  - Dietrich Limited
- **Pneumatic Machinery**
  - Canadian Ingersoll-Rand Co.
- **Portable Saws**
  - Canadian Fairbanks-Morse Co.
- **Portable Track**
  - Bechtels Limited
- **Power Engines**
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  - Jenckes Machine Company
  - Canadian Allis-Chalmers, Ltd.
  - Waterous Engine Works
- **Pumps and Pumping Machinery**
  - Beatty & Sons, M.
  - Boving Company of Canada
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Buffalo Forge Co.
  - Canadian Fairbanks-Morse Co.
  - Canadian Ingersoll-Rand Co.
  - Canadian Sirocco Co.
  - Cook, A. D.
  - Hamilton Mfg. Co., Wm.
  - Inglis & Company, John
  - McDougall Caledonian Iron Wks.
  - Smart-Turner Machine Co.
  - Waterous Engine Works Co.
  - Mussens Limited
  - Ontario Wind Eng. & Pump Co.
  - Wettlaufer Bros.
- **Quarry Machinery**
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Ingersoll-Rand Co.
  - Improved Equipment Co.
  - Lecky & Collis
  - George Anderson & Co.
- **Radial Brick Chimneys**
  - H. R. Heinicke Inc
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  - Hopkins & Co., F. H.
  - Lecky & Collis
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- **Revolving Stone Screens**
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- **Reinforcements, Concrete & Steel**
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  - Canada Wire & Iron Goods Co.
  - Greening Wire Co., B.
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  - Steel & Radiation Ltd.
  - Trussed Concrete Steel Co.
- **Road Asphalt**
  - Barber Asphalt Paving Co.
  - Asphalt & Supply Co.
- **Road Machinery**
  - Dore & Fils
  - Erie Machine Shops
  - Lecky & Collis
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  - Mussens Limited
  - Waterous Engine Works Co.
  - Western Wheeled Scraper Co.
- **Roofing Material**
  - Asbestos Mfg. Company
  - Barber Asphalt Paving Co.
  - Bird & Sons, F. W.
  - Can. H. W. Johns-Manville Co.
  - Metallic Roofing Company
  - Noble, Clarence W.
  - Paterson Mfg. Co.

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Ferranti Transformers

A transformer to be efficient must be economical to install, economical to operate and must have a minimum of core and copper loss. These good points will be found in Ferranti Three Phase Transformers.

Whether on the line or in the station Ferranti Transformers will give all-day high efficiency.

The design is very substantial and all parts are easily accessible.

Let us quote you prices

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

**Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG**

Our Special Discount Offer

is proving quite attractive, and our shipping department is somewhat exercised as a result of our last week's advertisement in the Record.

REMEMBER this 20 per cent. discount offer holds good only during the present month of December, 1913, and your order must reach us not later than midnight, December 31st, with cash enclosed. No shipments made otherwise.

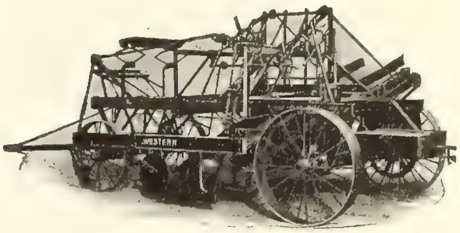
See our full page ad. in the December 10th issue of the Contract Record and send in your order accordingly as no deviation whatever can be made from the terms of this offer.

Our binding guarantee as published gives you every assurance of satisfaction, but those who know the "ABRAM" line of Tools, need NO guarantee.

Large New Catalogue FREE. Write for it today.

ABRAM CEMENT TOOL COMPANY
Windsor, Ont.

Load Your Wagons with a **WESTERN**



The contractor who wants the best Dump Wagon on the market purchases a Western. In the same way the Western Elevating Grader is his choice when investing in a wagon loader.

Western Elevating Grader

The Western will load wagons of 1½ yards capacity at the rate of three wagons per minute and one hundred per hour.

WRITE US FOR CATALOGUE

Western Wheeled Scraper Co.
AURORA, ILLINOIS

Earth and Stone Handling Machinery

Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta.
Can. Equipment Co., Montreal—Agents for Eastern Canada.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Goodyear Tire & Rubber Co.
- Canadian Fairbanks-Morse Co.

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- Sand and Supplies Limited
- York Sand and Gravel Co.
- Alfred Rogers Limited

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- Weller Mfg. Co.

Sewer Pipe
- Britnell & Company
- Canada Iron Corporation
- Dominion Sewer Pipe Co.
- Gartshore Thomson Pipe Co.
- National Iron Works
- Nova Scotia Clay Works Ltd.
- Ontario Lime Co., Ltd.
- Ontario Sewer Pipe Co.
- Smyth & Ryan
- Standard Clay Products Ltd.

Sewer Trenching
- Lecky & Collis

Sound Deadening
- Cabot, Inc., Samuel

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- Browning Engineering Co.
- Beatty & Sons, M.
- Canadian Allis-Chalmers, Ltd.
- Hopkins & Co., F. H.
- Montreal Locomotive Works
- Mussens Limited
- Thew Automatic Shovel Co.

Smoke Stacks
- Chicago Bridge & Iron Works
- Des Moines Bridge Co.
- Hamilton Mfg. Co., Wm.
- Walsh Plate & Structural Works

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- Lundy Shovel & Tool Co.

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- Cabot, Inc., Samuel

Stair Builders
- McGregor & McIntyre

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- Canadian Buffalo Forge Co.
- Pittsburgh Valve, Foundry and Construction Company
- Sheldons Limited
- Sturtevant Co. of Can. Ltd. B. F.

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- Mannesmann Tube Co.

Steam Turbines
- Canadian Allis-Chalmers, Ltd.
- McDougall Caledonian Iron Wks.

Steel
- Canada Steel Co., Ltd.
- Can. Billings & Spencer
- Lecky & Collis

Steel Bars
- Canada Steel Co., Ltd.
- Steel Co. of Canada
- Steel & Radiation, Ltd.

Steel Pipe
- Gerald Lomer, Limited

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- Britnell & Company
- Brodie, James
- Consolidated Stone Company
- Contractors' Supply Company
- Crushed Stone, Limited
- Hagersville Contracting Co.
- Mahan & Company
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- Morrison & Co., T. A.
- Myers, Oakley
- Ontario Lime Co., Ltd.
- Queenstown Quarry Co.
- Rogers Supply Company
- Sackville Freestone Company
- Sand & Supplies
- Smyth & Ryan

Stone Saws
- Anderson, Geo.

Store Fronts
- Zouri Drawn Metals Co.

Structural Iron and Steel
- Canadian Allis-Chalmers, Ltd.
- Canada Steel Company
- Chicago Bridge & Iron Works
- DesMoines Bridge Company
- Dominion Bridge Company
- Hamilton Bridge Works Co.
- Mackinnon Holmes & Co.
- Manitoba Bridge & Iron Works
- Maritime Bridge Company
- McGregor & McIntyre
- Phoenix Bridge & Iron Works
- Reid & Brown
- Sarnia Bridge Company
- Steel Company of Canada
- Structural Steel Company
- Standard Steel Construction Co.
- Walsh Plate & Structural Works

Submarine Drills
- Lecky & Collis

Swinging Gears
- Dake Engine Company

Tanks and Stand Pipes
- Chicago Bridge & Iron Works
- DesMoines Bridge Company
- Hamilton Mfg. Co., Wm.
- Inglis, John
- Jenckes Machine Co.
- Marsh & Henthorn
- McDougall Caledonian Iron Wks.
- Ontario Wind Eng. & Pump Co.
- Piggott & Co., Thos.
- Walsh Plate and Structural Wks.
- Waterous Engine Works Co.

Testing and Inspecting Bureau
- Hunt & Co., Robt. W.

Turnbuckles
- Canadian Billings & Spencer, Ltd.

Underground Conduit
- Dietrich Limited

Ventilating & Heating Apparatus
- Canadian Buffalo Forge Co.
- Canadian Sirocco Company
- Sheldons Limited
- Sturtevant Co. of Can. Ltd. B. F.

Vacuum Cleaners
- Tuec Company
- Canadian Allis-Chalmers, Ltd.
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company
- Pittsburgh Valve, Foundry & Construction Company

Varnishes—Insulating
- Standard Underground Cable Co. of Canada, Ltd.

Wall Board
- Bird & Son, F. W.

Waterproofing
- Cabot Inc., Samuel
- Can. H. W. Johns-Manville Co.
- Wadsworth Howland Co.

Water Softeners and Filters
- American Water Softener Co.

Water Tapping Machine
- Mueller Mfg. Co., H.

Water Turbines
- Canadian Allis-Chalmers, Ltd.
- Boving Company of Canada
- Escher Wyss & Co.
- Hamilton Mfg. Co., Wm.
- McDougall Caledonian Iron Wks.

Wires and Cables
- Canada Wire & Cable Co.
- Imperial Wire & Cable Co.
- Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
- Canada Wire & Iron Goods Co.
- Greening Wire Co., B.
- Steel Company of Canada

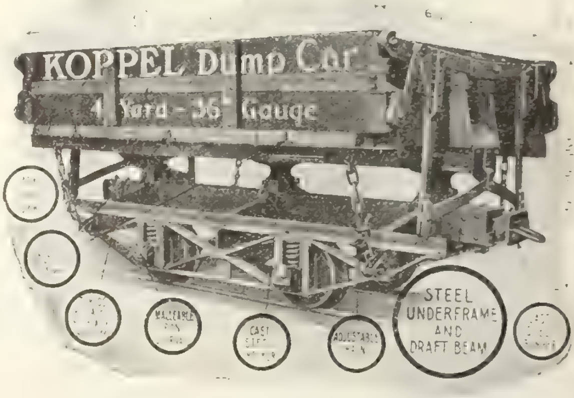
Wire Rope
- Canada Wire & Cable Co.
- Greening Wire Co., B.
- Steel Company of Canada

Wrenches
- Canadian Billings & Spencer, Ltd.

Wrenches
- Can. Billings & Spencer, Ltd.

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Barrett Specification Roofs

If you should specify merely "a five ply tar-and-gravel roof" instead of a "Barrett Specification Roof"—

You *might* get as good a roof as a Barrett Specification Roof though built somewhat differently—

But on the other hand, you may get materials of uncertain qualities,—

Or a roof with little or no pitch between the layers,—

Or a scanty surface coating of pitch and gravel—

And you wouldn't know about it until a few years later—*when the roof leaked*—

But if you put the Barrett Specification into your building specifications and see that it is carried out, you are sure—

1. That the materials will be right,
2. That they will be used in the right amount and in the right way,
3. That your roof will last upwards of twenty years without another cent of expenditure,
4. And that the cost per foot per year of service will be lower than it could possibly be with any other kind of roofing.

As Barrett Specification Roofs cost less than any other permanent roof to begin with and as their maintenance cost is nothing, the unit cost comes down to about ¼c. per square foot per year, a figure unapproached by any other roof covering.

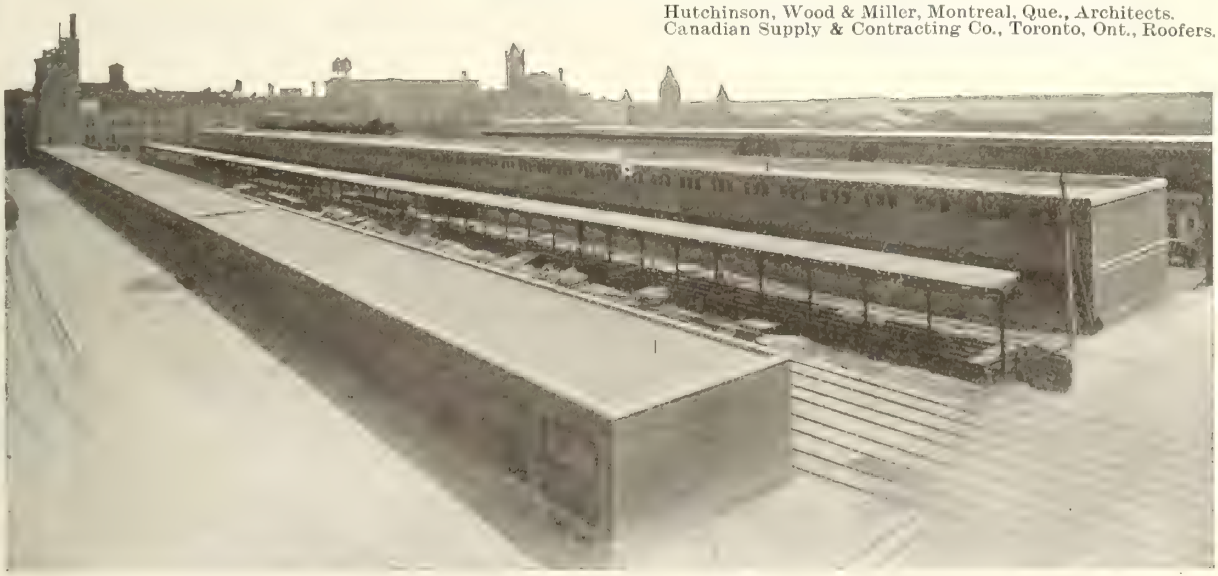
Copy of the Barrett Specification with tracing ready for incorporation into your building plans, sent free on request. Address nearest office.

Special Note We advise incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested. ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

THE PATERSON MFG. CO., Limited

Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

Hutchinson, Wood & Miller, Montreal, Que., Architects.
Canadian Supply & Contracting Co., Toronto, Ont., Roofers.



Canadian Pacific Railway Co.'s Freight Sheds, Toronto, Ont.

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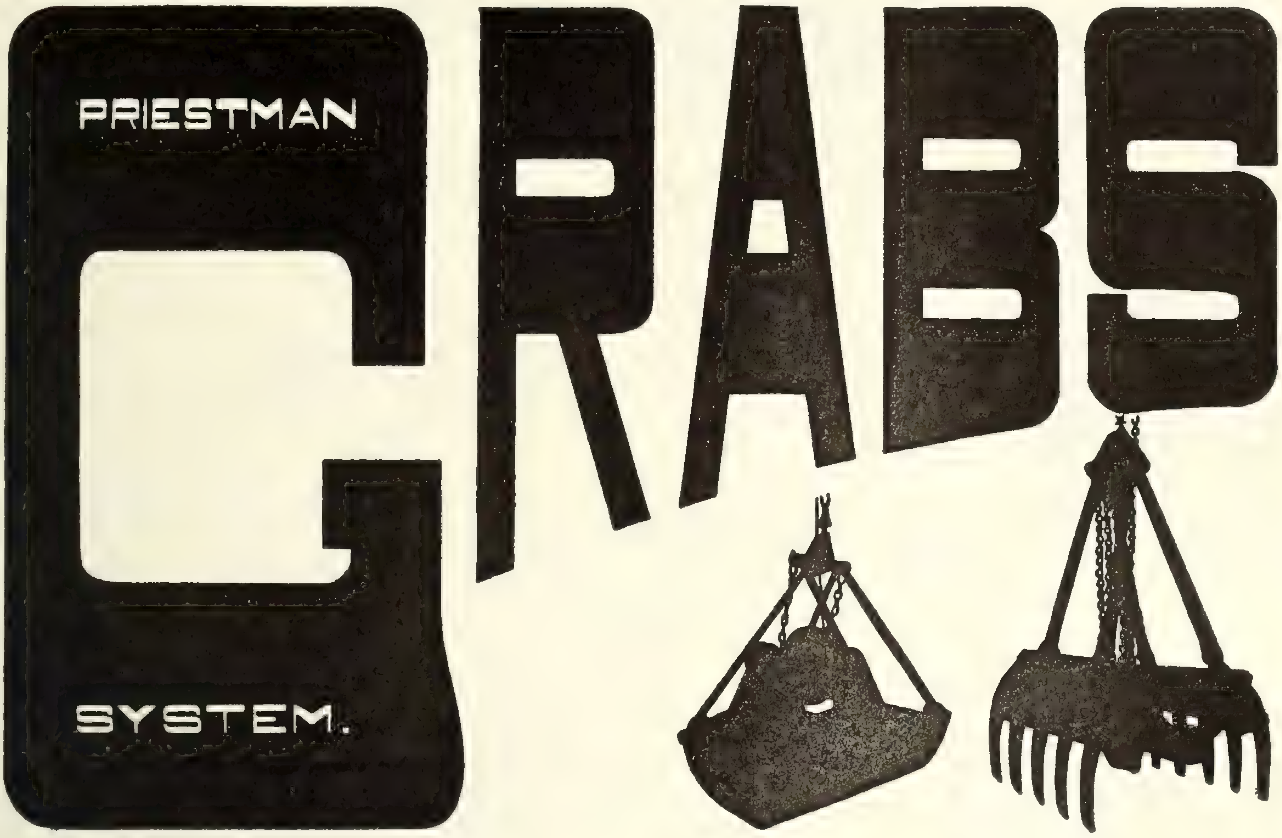

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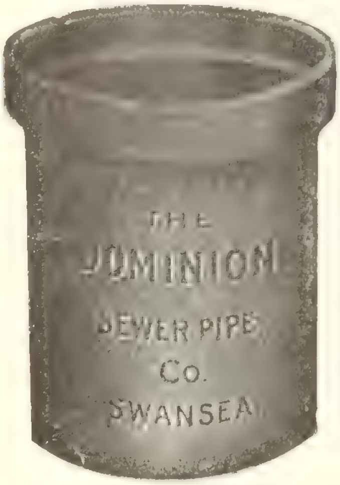

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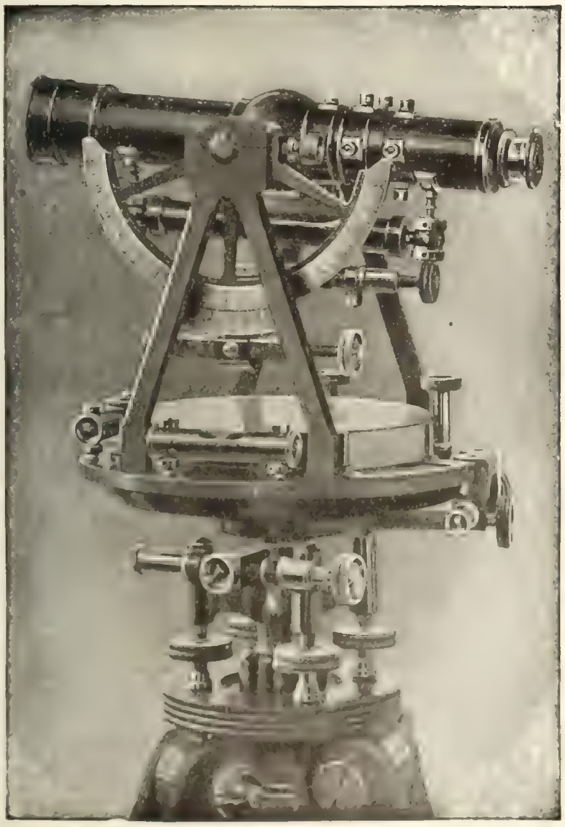

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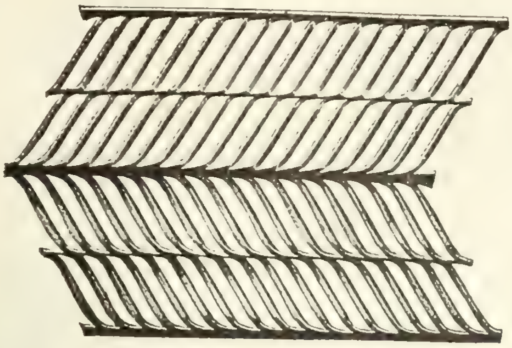

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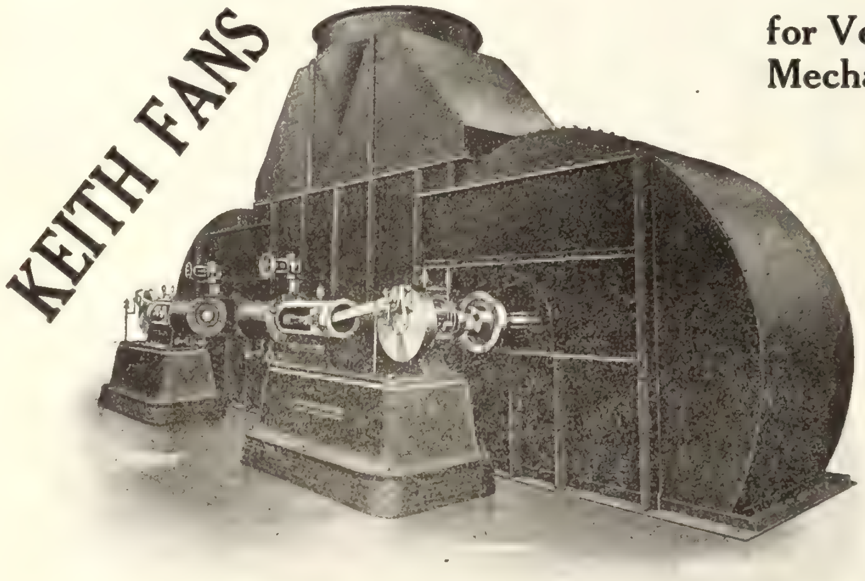

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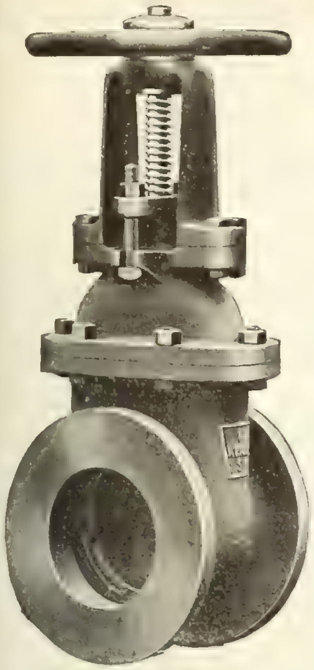

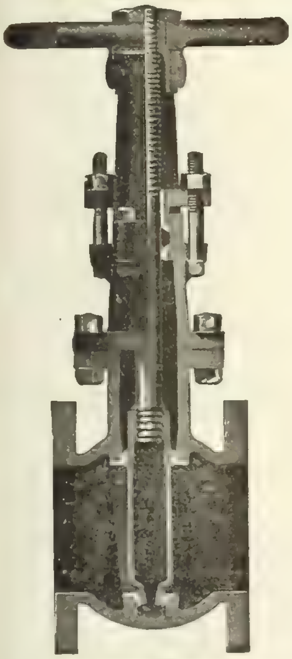

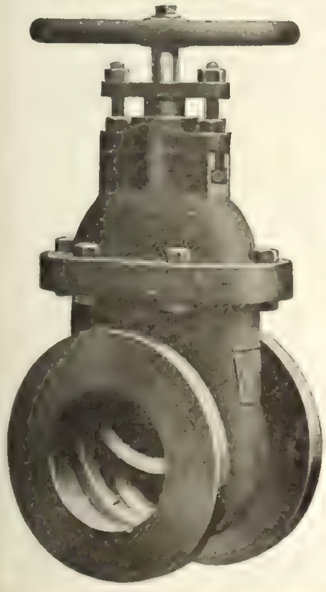

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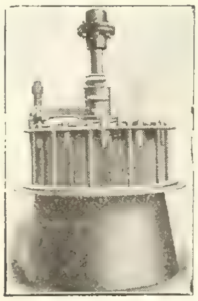

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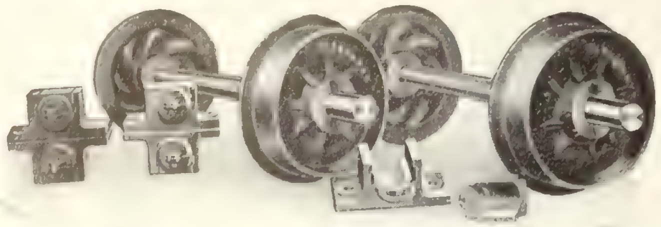

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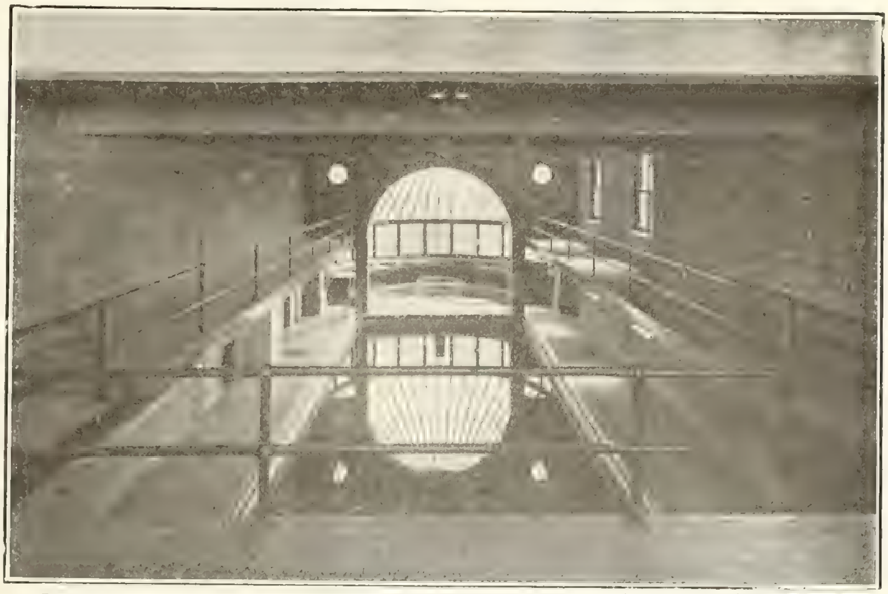

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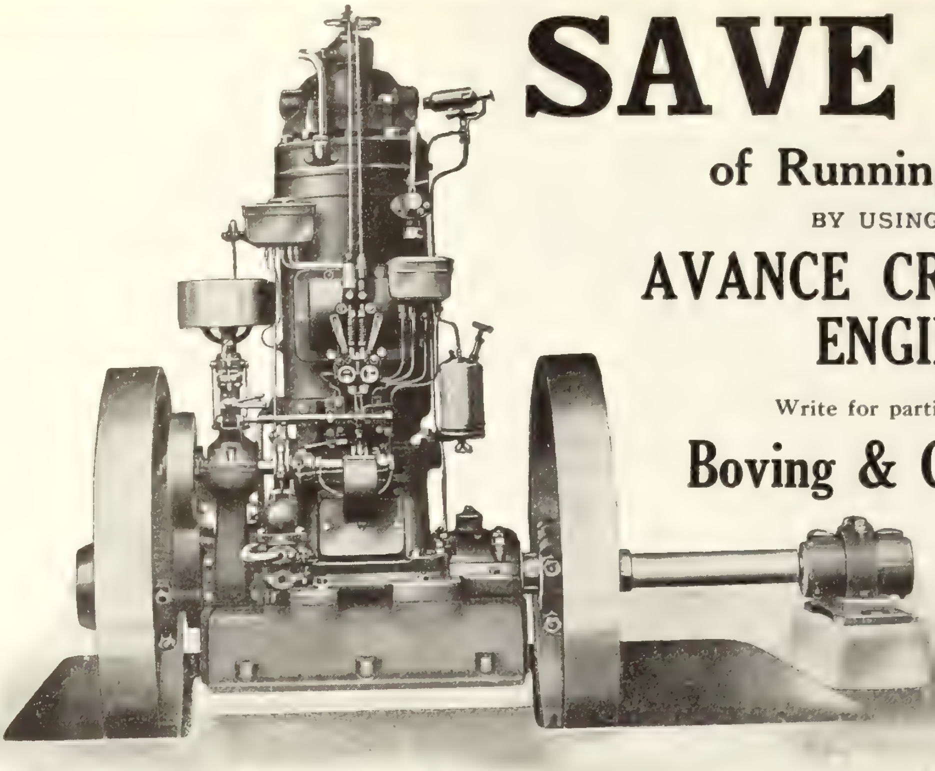

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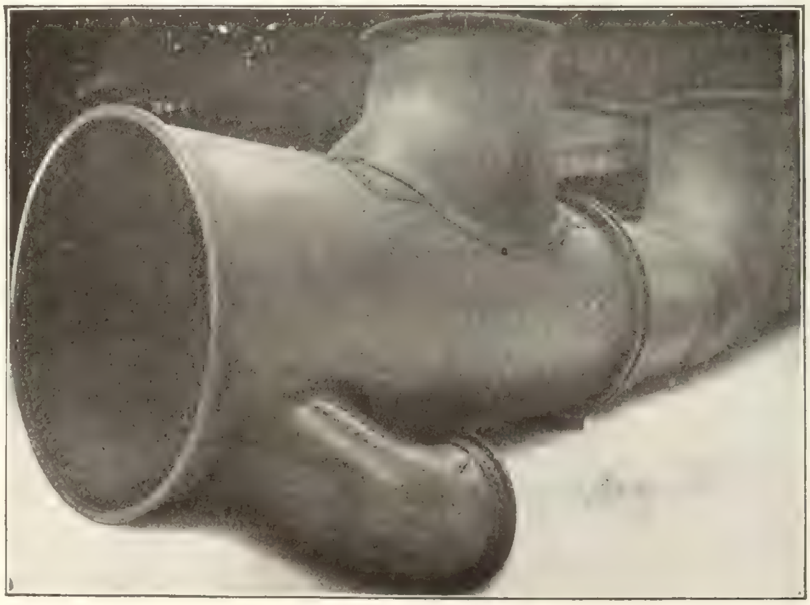

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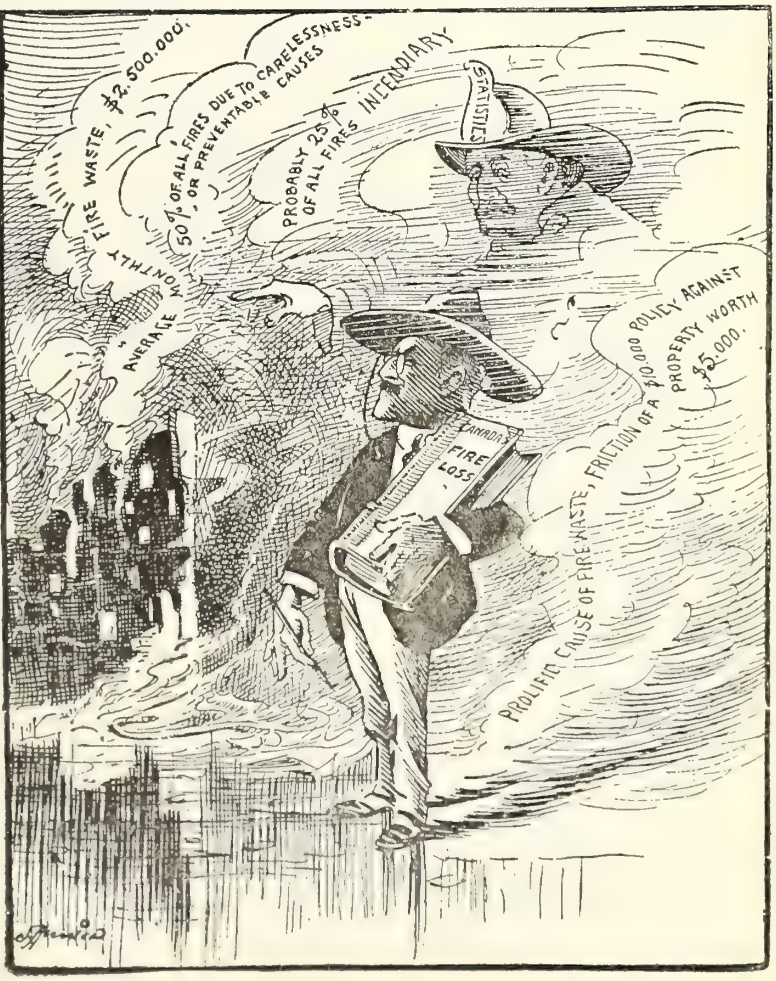
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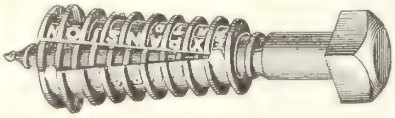

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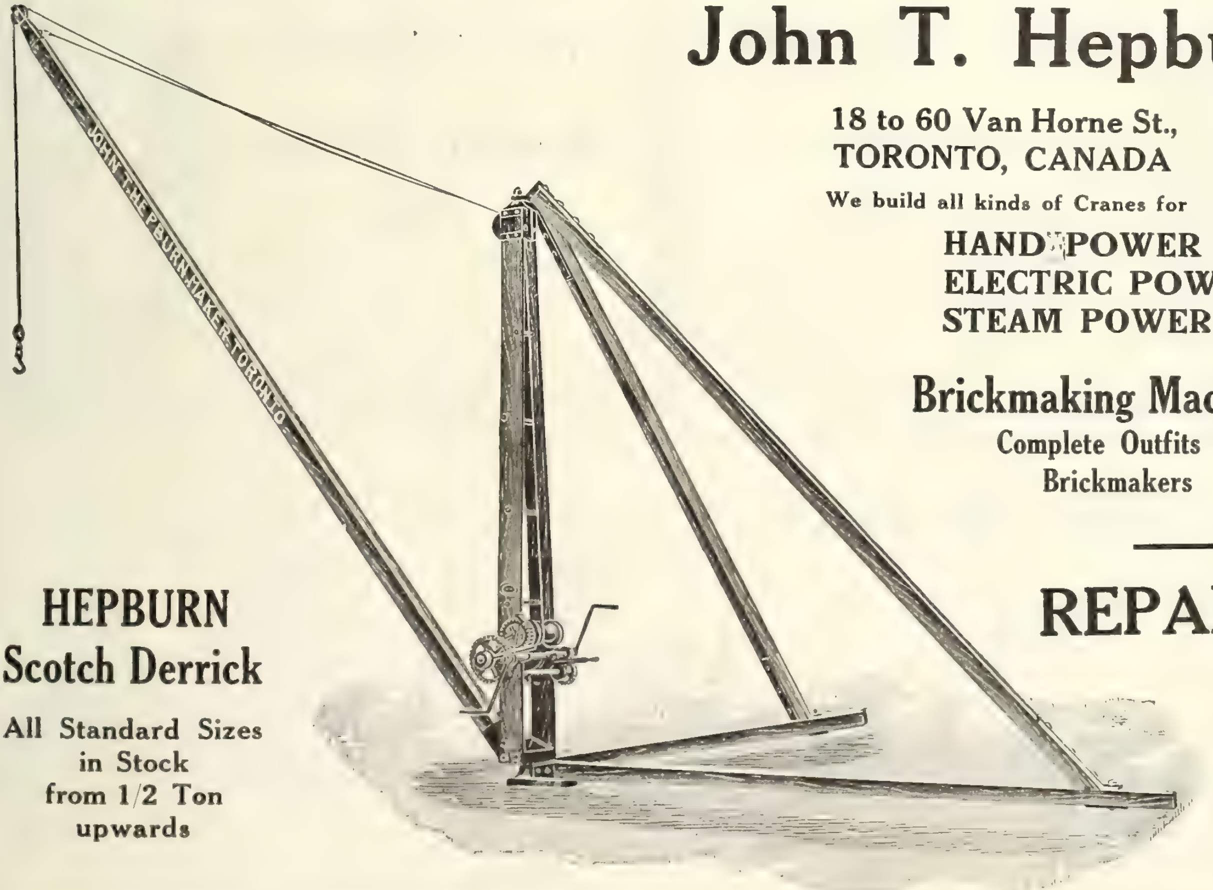
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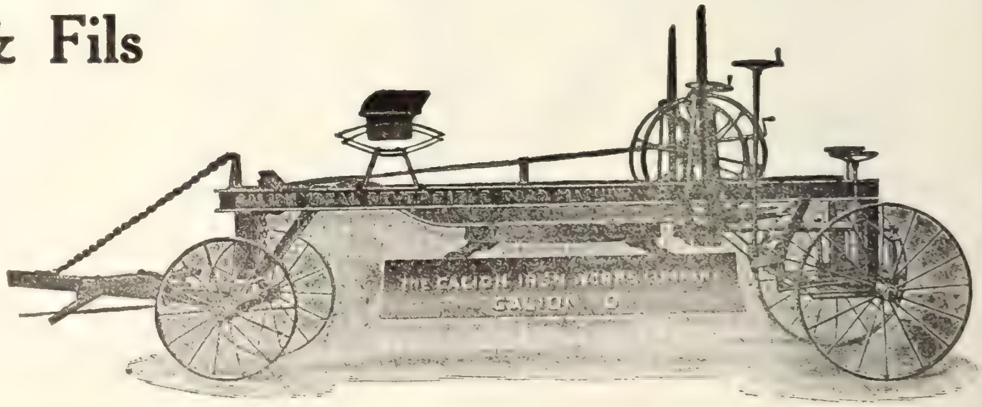
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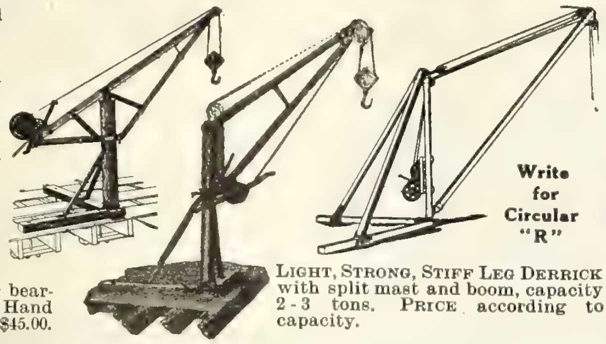

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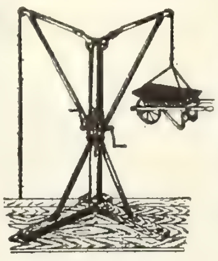
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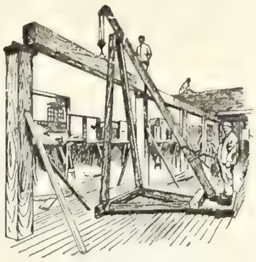
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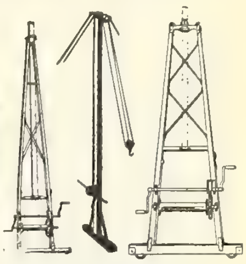
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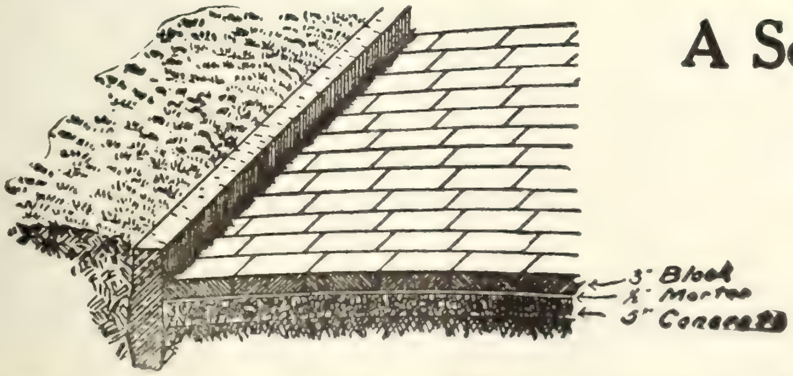

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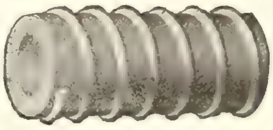

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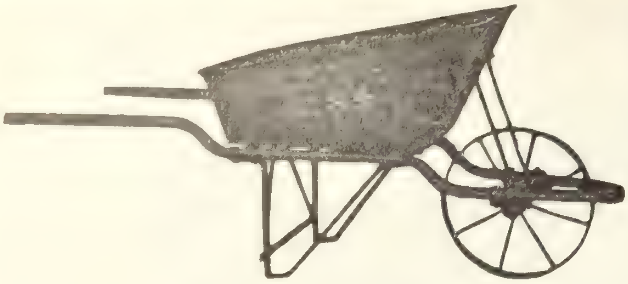

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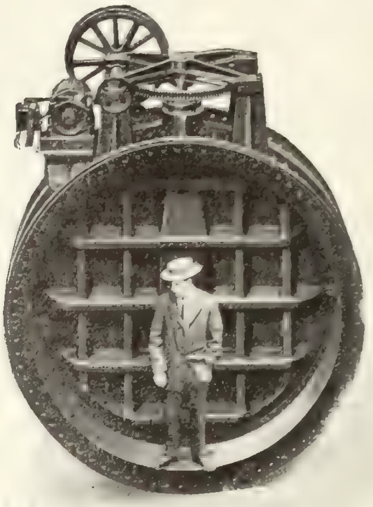

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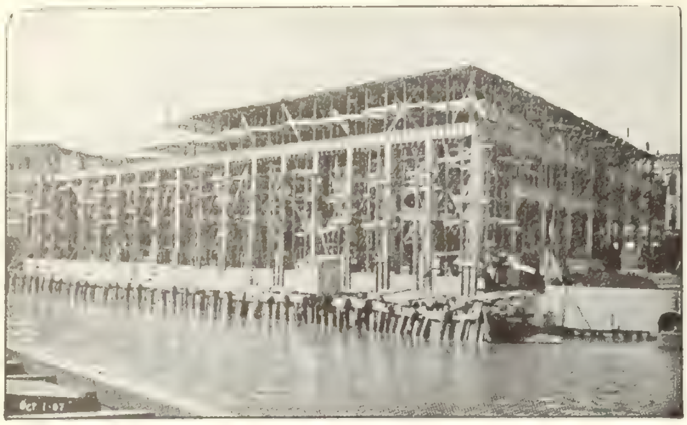

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ESTABLISHED 1886

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Page 16

Vol. 27 December 17, 1913 No. 51

"Commercial Immorality" Exemplified at Vancouver

IN an extract accompanying the letter of Messrs. Warren Brothers Company, Boston, published in our issue of December 3, the following opinion was expressed:—"I believe more can be accomplished by placing even greater responsibilities upon public officials, holding them to a strict accountability for the proper exercise of their duties, and then providing adequate means for the detection, exposure and correction of any abuse of the powers which may be entrusted to them." We take this observation as our text in what follows.

On another page we publish a letter from "One of the Contractors" for a section of the Greater Vancouver sewerage work. A perusal of this letter and some acquaintance with the history of the Vancouver sewerage scheme incline us to the opinion that the Burrard Peninsula Joint Sewerage Board, the authority to whom the work has been entrusted, is not—like Caesar's consort—above suspicion. The letter is written under a non-de-plume, but its author is an established western contracting firm of sound principle and high reputation, and as no extravagant attack is made upon the in question, there can be no substantial objection to the contribution on the ground of its anonymity.

So far as we know, and so far as we are able to substantiate from our own knowledge and from local press reports, the letter constitutes a simple history of the case. If we are to believe our correspondent, and if we are to place one iota of confidence in the testimony of the Vancouver papers, the Burrard Peninsula Joint Sewerage Board got half a dozen leading contractors to tender upon three or four hundred thousand dollars' worth of work and after having obtained figures changed their mind and decided to carry out the work by day labor, "for the benefit"—we are told facetiously?)—"of Vancouver's poor during the winter months."

We are entirely in sympathy with those who have come down to a state of comparative destitution in a city of doubtful philanthropy and easy virtue like Vancouver, but we fail to see why good works should be done by local authorities at the cost of contractors. Right here, in our opinion, there is justification for the claim put forth editorially in our issue of November 12, namely, that in cases such as this the contractor should be reimbursed for the trouble and expense of tendering. The objection has since been made that if such a system were adopted we should soon have a number of unprincipled people in the business for what they could make out of it without doing any actual work, but we fail to see how this can be sustained in view of the fact that in undertakings of any magnitude the "privilege" of tendering is only—and need only be—extended to a limited number of firms qualified to tender by virtue of practical and financial competency. We find that the tenders submitted for the construction of the sewerage system at Vancouver ranged in value from $240,000 to $360,000. Six contractors submitted bids, and of eleven proposals—which included five alternatives—nine of the bids submitted ranged between $240,098 and $285,670, so that the Board can hardly defend its action on the ground of there being much disparity between the bids received.

It is an outrage to make such a sudden and radical change with the simple explanation that the proposals submitted were unsatisfactory and that the community will derive greater advantages by having the work carried out under day labor. Why not a specific statement giving full details of the bids submitted and recounting frankly the engineer's objections in each case? If there is a written law which punishes a man for steal-

CHRISTMAS, 1913

" Thou may'st see a sunshine and a hail
In me at once; but to the brightest beams
Distracted clouds give way."

—All's Well That Ends Well.

ing from another man's pocket why not an unwritten law which can be brought into effect against a man who steals the fruit of another man's brains? Has competition reached such a point that contractors must submit tamely to any conditions imposed upon them? Surely contracting conditions are hedged in sufficiently with certified cheques and other securities without putting men to the laborious work of figuring quantities and alternative quantities for nothing. We reiterate our contention that it is commercially immoral to compel any man or body of men to work for nothing or to dispose of a man's work gratuitously through some ultimate change of plan.

It will be interesting to follow the construction of this section of the Greater Vancouver Sewerage System. We do not doubt for one moment that it will contrast unfavorably with contract work from the point of workmanship, time and cost. Under day labor where will be the incentive to essay a creditable performance? Whose reputation will be made? What single individual will suffer from the improper distribution of labor, or waste of time and materials? Certainly not the superintendent of construction whose position we see has just been advertised in the local papers. He cannot have the vital interest of the contractor. The salary of the superintendent and his assistants will be paid by the Board, the Board will pay themselves in some manner or other, and the man in the street will foot the bill, while the men who should have carried out the work occupy the side benches.

As a journal which has a recognized standing in the contracting world we should like to ask the Burrard Peninsula Joint Sewerage Board for an explanation covering in detail the matters which we have recited.

Completion of the Bassano Dam

FOLLOWING some three years' work, the Bassano across the Bow River, in the vicinity of Calgary, has been completed by the Ambursen Hydraulic Construction Company of Canada, Limited, Montreal, for the Canadian Pacific Railway. The work, entailing the expenditure of several million dollars, has been carried out under the supervision of Mr. J. S. Dennis, assistant to the president of the C. P. R. and head of the Natural Resources Department of the company. By means of the scheme a million acres of prairie land hitherto of little value for agricultural purposes is placed under irrigation and will be made productive. The remaining portion of the scheme will probably be built next year. The greater part of the earthwork for the canals, aggregating twenty million cubic yards, has been finished and operations well advanced on the principal structures. The remaining work to be done consists largely of placing over a thousand small structures, mainly wood, scattered over the irrigable tract covering the greater part of 2,000 square miles. The water supply comes from the Bow River.

The quantities, as shown by the records of the Dominion Government, are large, the river receiving the drainage from over five thousand square miles above Bassano. It has a heavy spring flow, the highest stages being reached between June 15th and August 15th, thus furnishing an ample supply well through the crop season. At other times its affords adequate quantity for conveyance through the main canal to the storage reservoir located within the irrigable tract. This provision of storage for a part of the irrigable area and in the vicinity of the farms is an assurance against certain classes of operation troubles.

The low water surface in Bow River is raised approximately 40 feet by the Bassano Dam, located 83 miles east of Calgary. It is a composite structure, the great feature being the concrete spillway 720 feet in length. This is built with regard to economy of material and is of the Ambursen type, with heavy floor on the bed of the stream, protected by suitable cut-off walls. Upon this are erected buttresses carrying a sloping deck with apron, the whole designed to pass 100,000 cubic feet of water per second with extreme height of 13 feet above the crest. The concrete portion of the dam is prolonged westerly within the Horse Shoe Bend by an earthern dyke with maximum height of 45 feet and length of 7,000 feet, containing about 1,000,000 cubic yards. Extending easterly from the dam is the main canal, five miles in length, partly in a deep cut of 70 feet bottom width, and which, being made in earth of somewhat treacherous character, has given considerable trouble. In this respect it is comparable with a number of similar deep earth cuts which have been made and successfully maintained under similar conditions on canals in Montana and adjacent areas. Beyond the eastern end of this cut, the main canal, the capacity of which is 3,800 cubic feet per second, divides, the smaller portion, with bed width of 30 feet and capacity of 800 cubic feet per second, turning toward the north, while the larger

Panoramic view of the great Bassano dam.

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* The irrigation projects of the C. P. R. in Alberta were described very fully in an article by Mr. A. S. Dawson, Chief Engineer, C. P. R. Department of Natural Resources, in our issue of April 24, 1912.

A corner of the dam.

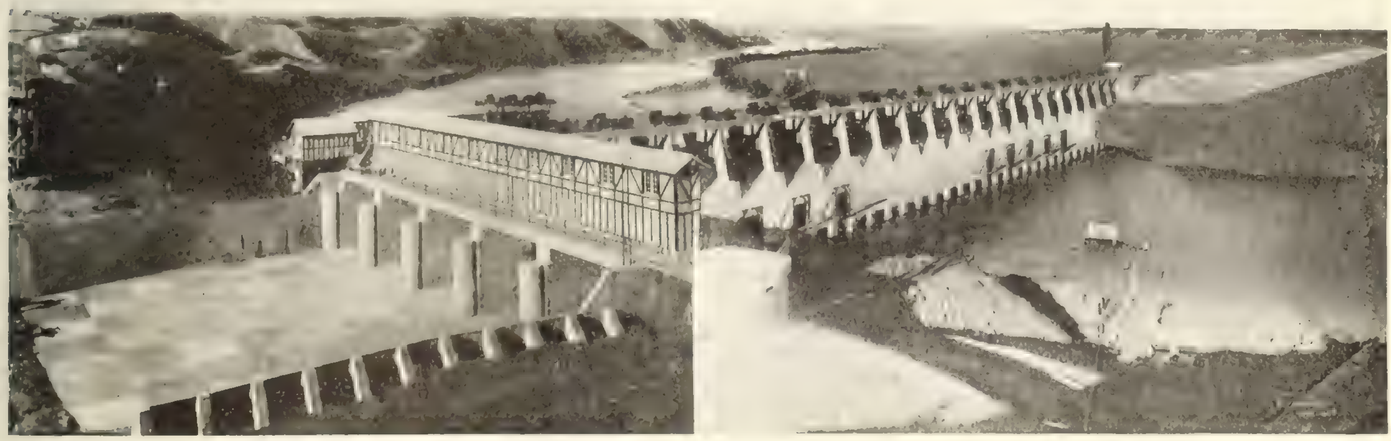
Sluice gates.

branch, with capacity of 2,200 second-feet, continues toward the east. On the northern branch and its subdivision are many structures, such as drops and flumes, but the greater number of these are on the eastern canal and its sub-divisions.

The most notable of the canal structures is the Brooks aqueduct, 10,000 feet in length, with capacity of 900 second-feet, crossing a broad low depression. The design of this aqueduct is novel, being based on careful study with a view to permanence and economy of material. Practically all the larger structures in the Eastern Section have been, or are being, built of concrete, the chief exception being several large wooden flumes. The drops in the canal are of substantial design, constructed of concrete and embody features found to be necessary for their permanence. There is a considerable number of high earth fills built in place of flumes. The smaller structures for distributing water to the farms or groups of farms, numbering over a thousand, have not yet been put in place. As a new country develops, it will be necessary to make a number of changes in the distribution system, with the result that by the time the smaller wooden structures need renewal, there exists such a difference in methods and transportation possibilities that the wood can then be replaced to advantage with concrete. At the same time the plans can be modified to suit the developments which have taken place.

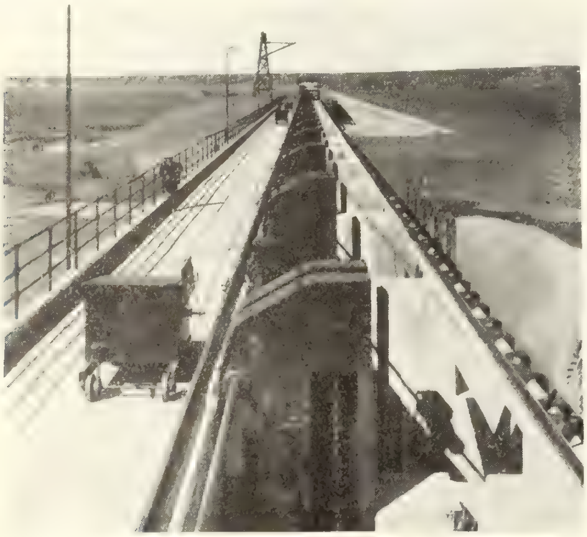
The area for which water is being provided, in general, is undulating and with slopes towards the Bow and Red Deer Rivers. There are a number of distinct drainage lines traversing the country, and the topography, as compared with that of most of the plains region, is favourable for a relatively rapid run-off of excess water. There is a considerable number of partly closed depressions, such as are characteristic of all glaciated regions. Provision has been made for draining many of these or for connecting them up, affording outlets for the surplus waters. Thus the main drainage system has been provided in part by nature and in part by artificial means. In this connection experience has shown that, as far as possible, plans should be made in advance for delivery of water by rotation, allowing certain distributaries to be periodically dry so as to reduce the seepage of water from them and to permit the irrigated lands to be relieved from excessive saturation.

The first problem under the prevailing climatic conditions is to induce the farmer to exercise forethought and to use water at the right time; the second, and even more difficult, is to get him to appreciate the danger of using too much water. He is apt to assume that if a little water is a good thing, a large quantity is better, whereas, the larger quantity may be injurious to his crop and to his neighbours' fields, and ultimately may necessitate large, and otherwise unnecessary expenditures for deepening and extending the drains. In order to prevent the occasion for these large expenditures for drainage arising in the future, arrangements are made on many of the new



Panoramic view showing dam and head gates.

irrigation systems to deliver water on a measured basis, a certain minimum quantity being obtained at a flat charge assessed on all irrigable lands. For example, 50c or $1.00 is to be paid usually in advance, whether the irrigable land receives water or not, and for this, say, one acre-foot can be had. This minimum is set at the amount which is considered to be necessary for the production of the average crop under ordinary conditions, but it is not enough to result in water-logging the soil and in the consequent demand for drainage. For all quantities in excess of this minimum an additional charge is made and collected in advance. The result is that the irrigator, being called upon to pay out his money when he demands more water than the minimum, considers very carefully as to whether he really needs the water. Experiments have shown that the largest crop yields are obtained with the minimum amount of water applied, consistent with suitable plant growth, and that while many crops are tolerant of considerable amounts of water yet the yield is reduced in quantity and quality by such excessive application. The production of the best crops is, therefore, very closely joined with the conditions of carefully measured supply and the consequent avoidance of the necessity of incurring large expenditures for drainage of the irrigated lands. The plans already made and largely executed for the main drainage lines make ample provision for future contingencies. If the operation of the distributing system is carried on in accordance with the principles above noted, it is probable that any considerable large future expenditure can be avoided.



Looking across the Bassano dam.

Main canal.

The works have been advanced to a point where it is assumed that the final cost will be about $20.00 per acre of land irrigated for approximately 440,000 acres. This may be exceeded somewhat, but even if the cost rises to $25.00 per acre, or even more, it will still be less than the average of similar work executed in the United States. There, the prices of recently constructed large systems, with storage and with principal structures of concrete, average from $40.00 to $50.00 per acre irrigated. The relatively low cost of the Eastern Section, compared with the permanence of the work, is due to the large extent of the area irrigated and the simplicity of the entire system. It is understood that the preliminary surveys for the work on the Eastern Section of the Irrigation Block showed, as originally reviewed, a cost of approximately $16.00 per acre for 540,000 acres. Later it was found that the irrigable acreage must be reduced to about 440,000 acres, with accompanying increase in cost per acre. There is a probability at present that a new classification made on a more strict basis, taking the detailed surveys of each quarter-section, may cause a further shrinkage of the irrigable area with a corresponding increase in acreage cost. In explanation of the fact that the final cost will exceed the preliminary estimate of $16.00 per acre, it may be stated that there has been a general advance in costs of construction, accompanied by a demand for a larger number of permanent structures and greater elaboration of detail. The greatest factor, however, in increasing the acreage cost is that due to the general decrease of acreage upon which the cost must be distributed, due to the more rigid exclusion of small scattered tracts of land considered as non-irrigable. The era of low costs in irrigation construction has passed. Throughout the country the same condition prevails, namely, that the estimates of the engineers, as to what might have been accomplished four or five years ago under the then existing conditions, are being to-day exceeded in the actual operations. Engineers, like other professional men, are not prophets and must base their figures upon the experience of the past with such allowance as have proved wise; the increase in cost such as has taken place could not have been safely predicted.

The Eastern Section includes a million acres out of which there has been selected approximately 440,000 acres, lying in an altitude of from 2,300 to 3,300 feet, and which may be irrigated from the System as planned and nearly completed. The tract as a whole is a part of the Northern Great Plains, the surface of which has been modified by glacial action, with resulting heavy underlying deposits of sand and gravel, and particularly of clay, interspersed with large and small boulders. The resulting top soil on the glacial deposits is frequently loamy, usually very rich, and in places slightly sandy. Everywhere seen it is of suitable depth and quality for excellent crop production. The native vegetation, largely of various grasses, grows luxuriantly whenever there is an adequate supply of moisture.

Contour maps have been prepared covering the lands which can be reached by the canals. In the study of these maps the rougher, or more gravelly tracts have been eliminated as non-irrigable, leaving for consideration only those portions which appear to have an ample depth of good soil. There is no doubt as to the capability of these irrigable areas to produce highly remunerative crops if properly handled.

Correlation of the Engineer, Inspector and Contractor[*]

By F. L. Cranford[†]

BEGINNING less than one hundred years ago with the construction of the first steam railroad, nearly coincident as that was with the building of the steamboat, the other great factor of modern transportation, there followed an increasing volume of engineering work, not only in America but in all the great countries of Europe.

During the last twenty-five years the amount of construction work has been so enormous in volume as to make the previous performances by comparison little and unimportant. There has been in addition to a vastly increased volume, a great advance in skill in design and construction, in the application of scientific principles and methods, and in the adaptation of machinery upon engineering work. With this evolution and coincident with it there has followed a development of the contract system now in general vogue by the national, city, county and state governments and also by the great corporations, which brings into relation the engineer, the inspector and the contractor, and the works which these three agents are now performing are probably the most enduring contribution to this particular period of our civilized development.

It would seem to me fair to go a little further. The last century is no doubt going to take a very important place in the history of civilization, but its importance is not political. The great constructive political work in this century of our revolutionary period was in the eighteenth century and our civil war period was rather the correction of an error in the work of the seventeenth century than a constructive period of its own. In philosophy, literature and art there has not been any development which would eclipse for instance the Elizabethan period, but on the contrary, the nineteenth century's great work has been scientific—and scientific along many lines—agricultural, mining, mechanical, electrical, medical and surgical; but in no instance has the development been greater and the results so stupendous as in the engineering work witnessed in the construction of our railroads, canals, water power, city building, road building, harbor development, etc. The organization which in the main performed this work was the contract system with which we are all familiar, and therefore the relation to the other of the engineer, the inspector and the contractor—who may be said to constitute this organization—is a very important factor in the machinery of our present day civilization.

Within the memory of many actively engaged on public work, the duty of the engineer was limited to the drawing up of the plans and specifications of work and his relation to the contractor and to the work was largely that of a surveyor, giving lines and grades and making estimates. The inspector in many instances was not a subordinate of the engineer, but reported directly to the executive officer in charge of the work and frequently owed his place on public work to political considerations, rather than to any knowledge, experience or ability, that he may have had. The executive also exercised a much greater measure of control over both the contract and the contractor. The abuses which grew out of such a system were many and of such serious proportions as to threaten for a time the stability of the contract system. It is only a few years ago when the corruption which grew out of this imperfect organization was so great as to throw a stigma upon all who were associated with public work. With the perfecting of the organization which has largely taken public work out of politics and placed the engineer in charge, there has come, particularly to our cities, the only important advance in our municipal governments and it is a fair statement to make that this advance is due to the engineering profession.

Importance of the Engineer

The dominance of the engineer on our public work developed a conflict which raged with more or less severity between the practical and the theoretical and this conflict has been the important cause of most of the differences and disputes between us. The rule of thumb and the theoretical formula will always be a source of contention between the purely scientific engineer and the practical man; the former being skeptical of the value of the rule of thumb and the latter contemptuous of the theory of the engineer. When, however, both have had sufficient experience to allow them to grasp the fact that theory and rule of thumb spring from the same source if they are correctly interpreted, they will not be so far apart. Engineering is an exact science and its theory is therefore a formula tabulated from practice. The only difference between a formula and a rule of thumb is its more scientific form.

The Scientific and the Practical

As an example of the relationship between the scientific and the practical take a trip into the wilderness. What science will enable a man taken without previous experience out of our colleges or cities and placed in an unbroken wilderness to secure food and clothing and shelter; how quickly will he turn to the native or even to the savage for the practical help essential to his very life. The technique of the Indian in his skilful approach to, and let us say, capture of a deer and the various forms of knowledge required for the use of its flesh as food and of its hide as clothing and shelter, are no more remarkable nor less worthy of respect than the experienced practical man's skill and knowledge upon engineering work, and yet the remarkable Indian hunter is still a savage and his tribe will so continue without the scientific knowledge essential to civilization. So also the practical man must work with and under the scientific. The contractor, as the practical man, has found during the last two decades an increasing necessity for technical knowledge in the success of his work and a great improvement along these lines has already been accomplished. Is it not just as essential if not more so for the technical man to acquire a better and more sympathetic knowledge of the practical?

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[*] Paper presented at the Tenth Annual Convention of the American Road Builders' Association, Philadelphia, December 9-12, 1913.

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An engineering work is an economic problem always and the economic design and execution of any given piece of work must of necessity be greatly affected by the many practical considerations of its location with respect to transportation, labor, supplies and the geological formation, and of the technical and mechanical skill needed in its execution. The scientific engineer will not find the success he owes to his work or to himself without a proper knowledge of the practical problems involved. If the engineer's scientific knowledge is not of use to produce better work for less cost with proper relations to future development, it has been misdirected. The young engineer just out of college, placed as he usually is as a surveyor, lineman, or draughtsman, without authority or responsibility except as stated is, I am convinced, not given a fair chance to acquire either the scientific or practical skill needed in his profession.

There is a noticeable difference in the number of inspectors employed on public and private work, political considerations being still visible as a cause for this difference. A large number of inspectors is not helpful but practical skill and experience is necessary to proper inspection. It has been our experience that a small number of inspectors have not only been of assistance to hold within proper limits over-ambitious foremen, but have been of great assistance in matters of more importance, namely the safety of the work, the public and the workman; these questions have received too little attention in the past as the percentage of preventable serious accidents on public work has shown. Some believe it to be as high as fifty per cent., while the percentage of preventable minor accidents is much greater. A little less politics and more responsibility will strengthen the inspector in our organization just as it has benefitted the engineer. It may sound somewhat strained to talk about curbing politics with regard to inspectors, contractors being so free from such contamination; but seriously there is no doubt that political considerations were the important cause of writing into our public work, contracts and specifications, the usual iron-bound clauses in which the contractor surrenders any and all rights he may have as a citizen or under the laws and constitution of the state and nation calculated to hold him, his successors, heirs and assigns, to perform without cost any foible or eccentricity of the engineer and of which the engineer is sole judge.

Let me quote two clauses from contracts for the construction of the New York subway.

> "The specifications and contract drawings hereinafter mentioned and taken in connection with the other provisions of this contract, are intended by the Board to be full and comprehensive, and to show all the work required to be done. **But in a work of this magnitude it is impossible either to show in advance all details, or to precisely forecast all exigencies.** The specifications and contract drawings are to be taken, therefore, as indicating the amount of work, its nature and the method of construction so far as the same are now distinctly apprehended. The railroad is intended to be constructed for actual use and operation as an interurban railroad of the highest class, adapted to the necessities of the people of the city of New York. The contractor shall construct and complete the railroad in the best manner, according to the best rules and usages of railway construction, and if in the specifications or contract-drawings or in the provisions of this contract, any detail or other matter or thing requisite for such construction be not mentioned, **nevertheless the same is deemed to be included, and the contractor hereby undertakes to do the same as part of his work hereunder. And it is expressly agreed that the price to be paid to the contractor includes full compensation for every such detail, matter and thing."**
>
> "To prevent disputes and litigations, the engineer shall in all cases determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this contract; shall determine all questions in relation to the works and the construction thereof, and shall in all cases determine every question which may arise relative to the fulfilment of this contract on the part of the contractor. His determination and estimate shall be final and conclusive upon the contractor, and in case any question shall arise between the parties hereto, touching the contract, such determination and estimate shall be a condition precedent to the right of the contractor to receive any money under this contract."

Could there be a greater compliment paid to a man than this engineer pays to the contractor that tackles such a job?

Yes, the compliment to the engineer paid by the contractor when he signs that contract. A specification for a given piece of work has an underlying and fundamental meaning. It is a description of how to secure the construction with given materials of the best character of work obtainable and the relation which we bear to one another is largely by it. If the meaning be ambiguous and the requirements vague, it is very easy for the relations to degenerate into an effort to see how much each can get away with; a greater simplicity and a larger measure of fair dealing would seem to me to point to a great possible movement.

Limiting Arbitrary Power

While the unlimited authority given to the engineer to interpret and finally determine the meaning of the contract provisions is in practice nullified, first by enlarged estimates to meet the risk of an improper decision, and, secondly, by the enforced decisions of our courts holding that this power is really not conclusive, still some method should be devised which would not only limit this seeming arbitrary power of the engineer to make or break a contractor, but would also retain his authority to control and direct the progress of the work.

Public work in the United States is at present upon a high plane of accomplishment. Our great private work has been heretofore free from scandal and corruption, but curiously our organization (that is, the contract system, or the engineer, the inspector and the contractor), is in this particular I believe, to-day in greater danger from these causes upon private work for great corporations than upon public work. The work of the Panama Canal is an illustration, and the only great illustration on which our organization did not work together. My belief is that it only proves the rule as an exception and that the elimination of the contractor in that instance was proper and best. The twentieth century is just well started and looms big with opportunity, for we have done and are doing great work.

Factors Governing the Selection of a Road Surface or Pavement[*]

By L. R. Grabill[†]

THIS question has been so thoroughly considered by several eminent authorities, notably, among Americans, by Tillson, Byrne, Baker, and Frost, that little that is new is left to be said on the subject. The best that can be done is to consider these views from a slightly different angle, so as to show a somewhat different perspective.

The selection of a pavement or road surface is one of the most important of the duties of a highway engineer. The surface of the road or street, equally with the bridge truss or the retaining wall, should be neither over-designed nor under-designed as to the strength required to satisfy the conditions which it will be called upon to meet. In this particular the discrimination and care used must be similar to that of the architect in choosing the type of building suited to the case he has in hand, and to that of the bridge engineer in selecting the kind of bridge he will use. The road-builder or the pavement engineer must choose not only the type of surface which will be the easiest over which to pull a load, which will prove durable under the traffic that it will carry, and which will be adapted to the numerous local conditions; but he must, if his work is properly done, choose the surface that will produce these results with the minimum final cost both to the users of the road and to the community which pays for its construction and maintenance.

Nothing could be easier than to select a few types of road suitable to a few locations, and to adhere to these types, regardless of wide variations in the conditions; and this, it is feared, is too often done. It is very much on the safe side to assume that the character of pavement required for the most exacting purpose should be used for very different and lighter requirements; or to assume that the surface which costs the most will necessarily be the best; but it is not always possible to decide with such facility the question of what surface will prove the most satisfactory, under the special conditions involved, for the lowest total expenditure per ton carried over it. Yet this is the question to be solved in every new construction.

There is frequently the danger, too, that a lack of sufficient funds for the work proposed will cause the effort to be made to cheapen the first cost of construction beyond the limit necessary for durability; and it is not often that the road engineer finds enough funds available to build a better road than he wishes, if indeed he is able to build as well as his judgment dictates. In these cases, however, it is usually possible to limit the area covered, either in length or width, or both, so that a suitable character of surfacing may be employed.

It is assumed in this paper that all of the necessary requirements for the sub-grade have been met, such as those that relate to grade, drainage, and the preparation of the earth foundation for the pavement. These being the necessary and most permanent part of the road, should always be well done, in the best and most enduring manner that is practicable with the funds available, even at a sacrifice of the character of the surfacing, which will in time require renewal under any circumstances.

In considering the question from a purely academic standpoint, the availability of the funds necessary for constructing the kind of surface required for any given case may be also assumed, so that the question of cost presents itself only as a factor of the problem, and not as a limiting feature of the selection. This assumption is necessary, because if sufficient money cannot be obtained, the question becomes one of the selection not of the proper surface, but of the best one that can be paid for; forming a somewhat different problem, with greater limitations. In fact, the entire question may be said to cover two classes of cases, namely, those which are not limited by some special consideration, such as cost, grade, etc., and those which are so limited. The latter class is more frequently met with.

The word pavement is used, in this paper, for any class of hard surfacing of the road or street.

Mr. A. T. Byrne, in his work on Highway Construction, names the following as the essential qualities of a good pavement:—

1. It should be impervious.
2. It should afford a good foothold to horses.
3. It should be hard and durable.
4. It should be adapted to every grade.
5. It should suit every class of traffic.
6. It should offer the minimum resistance to traction.
7. It should be noiseless.
8. It should yield neither dust nor mud.
9. It should be easily cleaned.
10. It should be cheap.

Mr. G. W. Tillson, in the valuable chapter on "The Theory of Pavements" in his book on "Street Pavements and Paving Materials," appears to have originated the method of selection by assigning comparative values to the different qualities of surfaces upon a scale of 100, as follows:

Essential Qualities	Values
Cheapness	14
Durability	21
Ease of Cleaning	15
Light resistance to traffic	15
Non-slipperiness	7
Ease of Maintenance	10
Favorableness to travel	5
Sanitariness	13
	100

Mr. Tillson also gives, in his table number 51, a summary of the values of the various qualities which he assigns to different pavements, as compared with the full value in the ideal pavement. By combining the various values of the properties which are demanded to meet particular conditions this author shows how the selection of a pavement may be made. In speaking of the values as applied to various pavements, Mr. Tillson says: "It must be understood, of course, that the table is a general one; that much of it is based on the personal judgment of the author; and it will vary in different localities, even if the conclusions are agreed to."

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[*] Paper presented at the Tenth Annual Convention of the American Road Builders' Association, Philadelphia, Dec. 9-12, 1913.

[†] Superintendent of Suburban Roads, Washington, D. C.

Mr. Ira O. Baker in "Roads and Pavements," divides the qualities of pavements, and gives the relative values as follows, in percentages of the value of an ideal pavement:

Economic Qualities	Values
Low first cost	15
Low cost of maintenance	20
Ease of traction	10
Good foothold	5
Ease of cleaning	10—60
Sanitary Qualities	
Noiselessness	15
Healthfulness	10—25
Acceptability	
Freedom from dust and mud	10
Comfortable to use	3
Non-absorbent of heat	2—15
	100

Mr. Baker states: "The assignment of these numbers is wholly a matter judgment, and different individuals will differ greatly as to the relative values to be given to each quality. Different values should be assigned to the same quality according to the attendant conditions. The application of these principles is likely to be complicated by the personal interests of the residents or property holders."

An indication of the values of the qualities of different pavements is obtained from the average of the values as signed in ten replies by that number of paving engineers to an inquiry by the United States Forestry Service, which are tabulated as follows; using standard values which are apparently based on Mr. Tillson's but differ slightly, viz:—

named. These characteristics are practically those named in the tables cited.

4. The quotient obtained by dividing the total estimated traffic to be carried per unit of width into the cost per unit of area of the pavement during its probable life; including first cost and interest on the same; special surface treatment for dust suppression or other purposes; and any necessary repair until replacement; but not including the cost of cleaning. For the best pavement this quotient will be the lowest. This ratio may be called the ultimate cost of the pavement per traffic unit carried.

(1) The volume and nature of the traffic—not the present traffic, if the road now exists, but the traffic after the improvement—is the most essential factor. This must necessarily be approximated, and due allowance should be made for increase during the life of the pavement. The effect of traffic upon the pavement should be expressed in units of a known value, to which all classes of traffic can be reduced.

The different effects produced on a surface by different kinds of traffic are elements which must be considered. A certain tonnage in heavy slow-moving vehicles with iron tires produces an entirely different effect from that produced by the same tonnage in lighter rapid-moving automobiles with rubber tires; and a still different effect will be produced by the same tonnage in heavier and slower motor trucks. It has been well suggested that a traffic unit should be adopted, which could be used to represent, as far as possible in the same denomination, the amount of wear caused by the passage of one ton over the road in each of the several ways. The width of space available for travelled way must be considered in connection with the amount of traffic. Traffic when confined to a single vehicle width is very damaging and widening a few feet only may easily double or triple the life of a pavement.

Comparative Value of Different Pavements.

Qualities	Standard Percentage Value	Granite	Sand Stone	Asph. Sheet	Ashp. Block	Brick	Macadam	Creosoted Wood
Cheapness	14	4.0	4.0	6.5	6.5	7.0	14.0	4.5
Durability	20	20.0	17.5	10.0	14.0	12.5	6.0	14.0
Ease of Maintenance	10	9.5	10.0	7.5	8.0	8.5	4.5	9.5
Ease of Cleaning	14	10.0	11.0	14.0	14.0	12.5	6.0	14.0
Low traction resistance	14	8.5	9.5	14.0	13.5	12.5	8.0	14.0
Non-slipperiness	7	5.5	7.0	3.5	4.5	5.5	6.5	4.0
Favorableness to travel	4	2.5	3.5	4.0	3.5	3.0	3.0	3.5
*Acceptability	4	2.0	2.5	3.5	3.5	2.5	2.5	4.0
Sanitary Quality	13	9.0	8.5	13.0	12.0	10.5	4.5	12.5
	100	71.0	73.5	76.0	79.5	74.5	55.0	80.0

*Acceptability includes noise, reflection of light, radiation of heat and emission of odors, etc.

The prime factors which should determine the selection of a type of surface, when this selection is not limited by any necessity for giving undue preference to any factor, appear to be as follows:—

1. The volume and nature of the probable traffic over the pavement.

2. Conditions incident to the location of the pavement; including the character of the adjacent land and improvements; the character of the foundation; the kinds of adjoining pavements; the ruling gradients; the climatic conditions; and especially the availability and cost of different materials at the work.

3. The characteristics of the surface which will adequately meet physically, hygenically and esthetically the conditions expressed in the two factors first

One solution of the character of the roadway, when pleasure traffic and commercial vehicles use the same highway, is to construct a surface adapted to each, separated by a short distance, making a double roadway. This is done to the great advantage of the road users of every class where the travel is sufficiently dense to require it. It is customary, for the reasons indicated, as well as from an esthetic standpoint, to prohibit heavy traffic on roads built especially for pleasure drives. This factor of traffic, which is one of the most essential, is sometimes given the least consideration, and we occasionally hear of a county or township bonding itself for a costly form of surface where a gravel road would answer the probable demands for some time. On the other hand, in the neighborhood of cities, where the travel is already heavy and sure to increase, roads or pavements are frequently laid which are inadequate for even present conditions.

The nature of the future traffic is quite as important as its volume; although owing to rapid changes in the weight and speed of freight-carrying trucks, and the increase of motor-driven vehicles, this is difficult to forsee. An estimate of traffic on a city street made for thirty years hence would probably almost ignore horse-drawn vehicles, and would provide for the heaviest class of motor-trucks instead. If the traffic is to be of one class only, such as motor vehicles driven for pleasure with a moderate limit of speed, the problem is much simplified, and it is the writer's experience that no class of traffic is more easily or cheaply provided for. If there is to be a mixed traffic of horse-drawn vehicles, motor trucks, and other automobiles, with a possibility of the steam-lorry and train of wagons in the future, this combination will require a very strong and durable pavement, and first cost should be given little consideration.

There is an approximate limit to the amount of tonnage which can pass over any width-unit of pavement in a given length of time; and any amount of traffic approaching this would demand the very highest type of surface practicable to be constructed. This limit is probably seldom reached for more than a few hours daily on the heaviest travelled streets.

(2) The nature of the surrounding conditions is a potent factor in determining the character of the surface. In a manufacturing or wholesale district where noiselessness is less essential a granite or brick block may well be used on account of its strength or durability; whereas in a residential section the less durable but more quiet asphalt or wood block is better. In a farming or country area, a macadam or gravel road harmonizes more perfectly with the surrounding fields and woods.

The value of the adjacent property has a large bearing in the case, for it is the basis of the revenue which usually must be raised to pay for the improvements. A closely built city block can fortunately afford a much higher priced pavement than a less closely built suburban section, on account of its larger taxable value.

The character of the foundation governs the construction in many cases. An especially soft sub-grade may require a base of cement concrete; while, with certain types of pavement, upon hard ground, this might be omitted at a considerable saving of cost. If the problem be that of surfacing an old water-bound macadam roadway, it may be solved by using a surface, for instance, of bituminous concrete, placed directly upon the old macadam; whereas, if no such foundation existed, an entirely different type of pavement might be required. A rigid surface, such as one of cement, should never be placed where there is danger of settlement.

The ruling gradients of the road must be considered, for the reason that some pavements do not afford sufficient foothold upon steep grades, and the climate must be taken into account, since pavements are differently adapted to warm or cold or wet or dry conditions. The character of adjoining pavements will have weight with the engineer, except in cases where the requirements are very exacting. Again the practical consideration as to the availability of contractors and suitable construction plants in the vicinity must have weight as entering into the price to be paid.

Among local conditions, the availability of material, either local or foreign, the use of which latter largely depends upon the cost of transportation, is probably the deciding factor in more cases than any other. A city in an area producing excellent paving brick would be unwise to import granite block from a distance at a heavy cost for freight; or even to pay too heavily for the transportation of asphalt, and a western county could by no means afford to pay the cost of transporting the trap-rock used so largely on roads in the East, but must find the solution of its problem in the use of a surface of cement concrete or other material produced nearby. The very possibility of the construction of any roadway whatever, in many cases where the funds are limited, is dependent upon making the best possible use of the local materials available.

(3) The characteristics of the surface to be constructed, which must satisfy the requirements of the traffic, the environment, the foundation, the gradients, and the climate, may be divided into three clases, viz.:

(a) Those which are purely physical;

(b) Those which are required for health;

(c) Those meeting requirements of a more or less esthetic nature.

(a) The physical requirements are those previously stated, viz.: Strength; durability, ease of traction; sufficient roughness when either dry or wet to prevent slipperiness; imperviousness to a greater or less degree; sufficient smoothness to render the surface easily cleaned and to prevent excessive jarring of vehicles passing over it at high speed, and facility of repair, both as to openings and as to wear of the surface.

(b) The requirements as to health include noiselessness, freedom from dust produced by the wear of the pavement, and heat-absorbing and heat-radiating quality in a minimum amount.

(c) The esthetic requirements are such as appeal more directly to the senses. These are harmony with surroundings, a pleasing appearance, extreme noiselessness, and almost absolute smoothness. These qualities in their highest degree are usually demanded only in connection with streets of the highest class, or with pleasure drives.

Examining these characteristics further, but without going into details as to the qualities of materials, we find as follows:

Imperviousness is a very important feature, both from a sanitary standpoint, and as a matter of increasing the durability. No very permeable surface can be considered a good one.

Smoothness is particularly demanded by motor-vehicles, especially where speed can be used. Non-slipperiness is produced by slight irregularities in the surface. It is necessary for good foothold and to prevent skidding of rubber tires when the surface is wet.

Facility of repair is essential; and for this reason the pavement should not be constructed of materials and by methods which will be difficult to duplicate after the completion of the original pavement, without at least providing for its repair. Block pavements lend themselves most easily to repair, since they require no large plant for that purpose.

The sanitary requirements are mostly for the benefit of the public living or working on the streets, and less for the road-user. A noisy pavement with much travel seriously affects the nerves of those near it; a dusty pavement permits fine grit to be carried into eyes and lungs and becomes a muddy pavement in wet weather. A heat-absorbing and heat-radiating pavement, such as sheet asphalt, if exposed to the sun, adds much to the temperature of the street and the surroundings in the hot weather, to the discomfort of all in its vicinity.

The esthetic requirements are such as add a touch of good taste, and perhaps of luxury, to the road and are increasingly in demand.

All of these requirements will have somewhat different weights in different cases. Some of them can be omitted in considering nearly every case, and must be omitted often. In view of this it seems best not to assign special values to these requirements; but in each case to give preference to such characteristics as the situation demands, and to use the surface combining these characteristics in the greatest degree.

(4) This combination must produce a pavement, usually, which will give the lowest ratio of total cost to the total traffic units to be carried. The surface thus chosen should be that which is best adapted to the purpose.

In instances in which a high first cost might be prohibitive, the pavement showing the lowest cost-tonnage ratio could not always be selected; and a less costly surface with a higher rate of maintenance would be necessary.

The process of selection will usually be one of elimination, thus, for a certain case of proposed construction several well-known classes of pavements, of nearly equal theoretical value, will be considered; say, granite block, vitrified brick, wood block, and sheet asphalt. If low cost is paramount, this element may eliminate the granite block and the wood block; and if noiselessness is desired, the vitrified brick will be eliminated; leaving the sheet asphalt, or a similar surface, to be adopted. If durability alone is considered, the granite block might be chosen where this material is convenient; whereas, if the case demanded noiselessness, smoothness and durability in a high degree, without especial reference to first cost, the wood block would probably receive the verdict.

A resident paving-engineer familiar with the local conditions and with pavements in general often need not tabulate or even assemble, otherwise than mentally, the reasons for his choice, and this mental way is very often the method of selection employed. In such cases, however, the same conditions should, and do, actually control as would be the case if the situation were being considered for the first time with the utmost pains.

In order to proceed with system in the matter of choice of a new pavement, or one in a new location, the engineer should have the necessary data as to traffic; as to cost of construction and maintenance of similar pavements in the vicinity, or under like conditions; as to the life of such pavements; as to climatic conditions, and, in fact, all available information on the subject. It is unfortunate that the supply of information on the subjects is not what it should be. This is a defect which every highway engineer can aid in correcting, by careful investigation and records in connection with his work. In the absence of the necessary data, the selection is merely an assumption based on judgment and experience, and sometimes on a desire to experiment, and this is the manner in which the choice is very often made.

On the whole, the selection of a pavement, like the tariff, is largely a local question, and in its final aspect, when under practical consideration, presents such a number of features, some of which are predominant at one time and some at another, that each case must usually be considered alone.

The matter is well summed up in this quotation from Mr. Tillson: "The official who decides on the material after the most careful investigation will often find that his decision is displeasing to many people. . . . . He must make his decision after taking all things into consideration, and stand by it, although it will not always prove satisfactory to all. . . . But if he meet the question successfully, and ultimately arrive at the true solution, his satisfaction is as great, perhaps, as in any other branch of his profession."

Water in Concrete Mixtures

THE occasional failure of important concrete structures, when subjected to floods or other unexpected conditions, indicates that low cost and profits are given more consideration than strength and durability. Then, again, from the writer's observations of the work of others, he is led to believe that while a careful study has been made of cement, sand, and aggregate, the function, purpose, and effect of water in the mix is little understood.

Cement, sand and the coarser aggregates are inert solids without cohesive or adhesive power. Water, on the other hand, is a fluid with adhesive or sticking power to join two substances together. But water has a very strong surface tension. This is exhibited in what is known as capillary attraction. It is water that binds the inert materials together. This binding power is greatest when every particle of cement, sand and aggregate is covered with a continuous film of water. If too little water is present, or if it is not evenly distributed, the water film will be broken. If, on the other hand, the thickness of the film is increased to the filling of the interstices between the aggregate this binding power decreases until it is nothing when the solid particles of the mix become immersed in the water.

In addition to being a binder of the solid elements of the mix, the water acts as a lubricant, allowing the solid particles to slip on one another and assume positions resulting in smaller interstices. This increases the density of the mass, and also the capillary attraction of the water film, provided there is not sufficient water present to destroy this film tension. When the excess of water destroys film tension the solids become separated or "suspended" in the fluid. The finer particles of cement float in the water, filling the interstices or settle from the mass on agitation, and at the same time the "lubrication" of the larger particles is not increased.

It is the finer particles of the cement that develop the greater strength, but when suspended in the fluid or separated from the mass, the "hands" of these particles are not sufficiently long to bridge the water gap separating them from one another or from the larger solids.

It is far easier to build up the water film by careful addition of water than it is to distribute the water after it has been added. If excess of water is added to one part of the mix, so as to "float" the fine particles of cement, it is a question if the film tension can be restored by mixing this with drier materials. This kind of concrete may appear all right, but one part of the mass will not be sufficiently lubricated so the solids can assume the positions for greatest density, and the other parts will be over wet so that the particles of solids will be separated by excess water, and film tension will be lacking in either case. When water is poured or flows from a pipe or nozzle, this is sure to be the effect. The less nearly the cement fills the interstices of the aggregate the more pronounced the effect will be from improper watering. When the water is in just the right proportion to furnish the lubricating effect and the greatest binding power, these forces tend of themselves to draw the particles together into the dense mass.

The third property of water in concrete is to furnish the element that causes crystallization of the cement, giving to the concrete its strength. The observation of the writer leads to the belief that the crystal takes the best form when the water is present as just described. But this will not give sufficient water for the complete growth of the crystal. More water must be fed it during the time of curing in order to grow it to maturity.

The writer has used much bank gravel in concrete construction. He has found it economy to screen the fine from the coarse aggregate. Mix the fine aggregate and the cement, and then mix this with the coarse aggregate, thoroughly drenched. Following thorough mixing, water as needed is added by sprinkling until tempered to the proper consistency. The sand, fine aggregate, should be just sufficiently damp to cause the cement to adhere. This dampens the cement and establishes capillary attraction. The coarse aggregate has but little capillary attraction and, on mixing, its excess of water is taken up by the superior attraction of the finer materials. In this way the material is all bound together.

With proper watering and curing the same strength is developed with one-half the cement as with improper watering. And when the work is properly managed the cost is very slightly increased. This is true of either hand or power mixing. It is simply a question of whether it is best to add brains or additional cement to the mix.—Municipal Engineering.

Nineteen Thirteen a Record Railway Year

DURING the year 1913 the railways of Canada have had in hand, in one stage or another, fully six thousand miles of new construction. By June 30 last, when the year for railway statistics closed, between 1,800 and 2,000 miles had been taken into operation as finally completed, and since that date there has been immense activity. Including lines which have been surveyed, lines for which the contracts have been let, and lines for which the contracts have been completed, the total will run into the extraordinary figure quoted. At present the Canadian Pacific has well over 1,000 miles in hand, the Canadian Northern not far short of 2,000, and the Grand Trunk Pacific about 1,000, while there also is to be considered the 500 miles of the Hudson Bay Railway and the National Transcontinental, which now is nearing its completion. The present activity in construction work constitutes a record.

Pulleys with insufficient breadth of face do not give fullest transmission efficiency. Usually the diameter of a pulley is given correctly, in accordance with the work they are called upon to do, but the breadth of the face is overlooked and the width of the belt is correspondingly small. As the power transmitted by a belt not getting all the power the diameter of the pulley leads one to expect. A narrow belt is poor economy.

What is a Proper Allowance for Depreciation in a Sewerage System?

WITH all the discusion that has gone on in the last few years, regarding proper depreciation allowances in accounting, we recall little or nothing regarding the depreciation of sewerage systems, comments the Engineering News. This is doubtless because sewerage works are almost without exception built by municipalities themselves, and they are in a large part paid for by assessments on abutting property. Other portions of sewer systems such as the trunk sewers and disposal works, however, are usually paid for by money raised by bond issues.

It is a universally accepted principle of sound financiering that the terms of a bond issue to pay for a public improvement should never be longer than the life of the improvement itself. It is a pertinent inquiry, from this point of view at least, how long the sewerage systems now being built are likely to endure. Probably most engineers designing and constructing a sewerage system, would say offhand that their work ought to last at least for half a century. It is doubtful, however, if the results of experience with sewerage systems built twenty years or more ago, justify the expectation of any such long term of life.

Some weeks ago we published an account of a sewer failure which recently occurred in St. Louis, where a circular brick sewer, 5 ft. in diameter and 44 ft. below street level, collapsed and caused a cave-in extending clear to the surface of the street. While by good fortune no loss of life resulted, the property damage was large.

The most serious feature of all, and the feature of most interest to engineers, is the cause to which the collapse is assigned. The sewer was built in 1878, the bricks being laid in ordinary lime mortar, without cement. The mortar has been gradually disintegrating, and weakened the arch until collapse finally occurred. Similar causes have without doubt operated to cause great deterioration in all old brick sewers laid in lime mortar. Nor need we limit the damage to this class of work. The erosive effect of the flowing sewage, and the disintegrating effects of both the liquid and the sewer gases upon cement mortar as well have caused great deterioration, without doubt, in a large portion of the sewers laid upon cement mortar, which are more than a score of years old.

A large proportion of existing sewerage systems, too, have suffered more or less damage from other causes, such as unequal settlement during street excavation and the discharge of improper materials into the sewers. Of equal importance with physical alterations of the sewers themselves in increasing depreciation is the changing character of the population and the consequent demands upon sewer systems. If cities and towns were planned in advance on an intelligent system, it might be possible for a competent engineer to design a sewerage system which would be reasonably certain of fulfilling at all points the needs of a city of 40 years hence, as well as that of to-day. But our cities and towns have not been and are not being planned in advance of their growth. Centers of population and of manufacturing industry change in unforeseen directions. Cities are compelled all the time not merely to extend their sewerage systems with the growth of population, but also to re-

re the layout. Sanitary commissions and state legislation have compelled the outlay of many millions of dollars on long intercepting sewers, the need of which was hardly thought of thirty years ago.

When we come to works for ultimate disposal of sewage, a still shorter term of life must be assumed, if we would be on the safe side. The changing demands of the public and of state legislation and the courts, have rendered many sewage-disposal plants obsolete only a few years after they were constructed. We are building more wisely in these matters without doubt than did our predecessors a quarter of a century ago, but it is absurd to suppose that we have reached finality or to expect that the works now being constructed for sewage disposal may not be supplanted by something quite different within not more than 25 years.

The general public knows little of these matters but the engineer knows them or should know them, and should lend the strength of his opinion and influence, to the end that money borrowed for sewerage construction should be repaid in a short term of years.

Unit Price, Lump Sum and Percentage Work*

By H. C. Hill†

THE subject of this paper, Unit Price and Lump Sum and Percentage Work, readily divides itself into a consideration of Percentage vs. Contract Work and Unit Price vs. Lump Sum Contracts. None of these methods is perfect and while under certain conditions one may be better than another this paper will attempt to prove that in a great majority of cases contract work on a unit price basis is the correct method.

Percentage work is nothing more than day labor, as far as the cost of manual work is concerned, and differs in a total cost in that there is at the start an organization with a certain knowledge of how the work should be laid out and executed and a man or firm whose reputation for not doing work at an excessive cost is at stake.

Contract work has everything that percentage work has and something in addition, namely, an incentive, which constantly spurs every man, to a more or less degree, depending upon his nature, to do the work set before him in the most economical manner and with the least expenditure of energy. Some will say that this is too true and leads in a few cases to poor work. If this is so it is not the fault of the method but the fault of those doing the work, more particularly those having supervision, for it is possible and it has been done, to eliminate entirely those contractors who desire only to make as large a profit as possible irrespective of the class of work done.

An attempt has been made to instill "incentive" into percentage work by establishing a price on each unit of work and paying a bonus on a sliding scale if the work is done at a less cost than first agreed upon. This is a very delusive point and those familiar with the variable factor in cost data will readily see the futility of this. Furthermore it will not take much of a mathematician to figure that it is the percentage that gives the contractor his profit and not the bonus, unless the agreed price is considerably higher than the actual cost should be. It being true then that percentage work tends to increase the cost of the work there remains the question of under what method of payment shall contract work be done.

In comparing the advantages and disadvantages of lump sum and unit price contracts it is possible to consider them under two heads namely, the engineering feature and the moral aspect.

So much has been written and said on the former that nearly all of you are familiar with that phase of the question, so under this head only that point which has the greatest bearing will be considered; namely, the relative cost of the two methods. Let us then consider the engineering feature first and the moral aspect second as the latter is the one which needs more attention at the present time.

The point upon which the advocates of the lump sum method lay the greatest stress is that the cost of the work is reduced by having the engineering charges a minimum and those of this opinion are wont to tell how much cheaper work is done, basing their comparison on an average cost, as in highway construction the average cost per mile, instead of basing their comparison upon the actual amount of material moved or used. The truth or falsity of this statement is not subject to specific proof, for it is impossible to have the same piece of work done using both methods, but is subject to proof in a general way. However, a very close approximation might be obtained if desired by procuring bids for the same piece of work on each method, then after the work was completed comparing the average of all the lump sum proposals with the average total of all the unit price proposals, using however, as a basis for the latter, the actual unit quantities as shown by a final estimate, not the bidding schedule quantities. This is, perhaps, more theoretical than practical, but what in the writer's mind is a satisfactory proof that under lump sum contracts the work costs more is the following: No reliable experienced contractor will bid as low on a lump sum proposal as he will if the work is to be let on a unit price proposal. This is a definite statement but one which a majority of contractors will agree to, and for this reason contract work in any form contains certain factors, the exact nature of which it is impossible to determine definitely until after they are encountered, and every contract, except it be a percentage contract, must necessarily be more or less of a gamble. Therefore, no contractor overlooks this factor and you can rest assured the larger the risk the higher the bid. This element of risk is less on a unit price contract than on a lump sum for under the former should a certain class of work increase over the estimate the contractor gets a corresponding increase in pay and should less work be done he gets a corresponding decrease in pay. Under the lump sum method such changes have no effect upon the amount of money received by the contractor for doing the work.

In some cases under lump sum bids estimates for the various quantities are prepared but the general practice is for the bidder to ascertain for himself, either by his own engineer or by guess based upon general knowledge. Even in cases where careful estimates are prepared the final quantities are not the same as those upon which the bid was made out, therefore as far as payment is concerned under this method estimates are of no value. The fact, however, that there is a variance between the preliminary and final estimates is not the fault of the engineer, for it is impossible to determine accurately the exact quantities until the work is completed.

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* Paper read at the Tenth Annual Convention of The American Road Builders' Association, Philadelphia, Dec. 9-12, 1913.

† Engineer, Lane Construction Corporation, Meriden, Conn.

Theory of the Unit Price Method

The theory of the unit price method is a very simple and just one and expressed in a few words conveys this idea: the contractor is to be paid for just what work he does and to do what work be gets paid for. Nothing could be more equitable than this. However, like everything else, it has its imperfection, but not of a very serious nature. Its weakness lies not in itself, but in the hands of inexperienced men, incapable through ignorance of properly preparing unit quantities. This weakness causes what is known as unbalanced bidding and consists of bidding high on items, the estimates of quantities of which in a contractor's judgment is lower than will be used, or vice versa, and so regulating his bid on these items that he will lower his total bid on one hand and at the same time increase the aggregate amount he will receive for doing the work. This results some times in putting an engineer in an embarrassing position and has therefore caused some to condemn this method. Before taking this stand they should ask themselves if an unbalanced bid is any worse than an unbalanced bidding schedule prepared by engineers and if what criticism of unit price method there is, is not primarily due to those who make the estimates and not to the contractors. If engineers were as careful not to leave any loop-holes in preparing estimates for contractors to bid on as they are in making out specifications for them to do the work by unbalanced bidding would become almost an unknown quantity.

Another advantage of having work done by unit prices is that it enables changes to be made while the work is in progress with the least possible chance of any dispute and as a rule at a less cost than by lump sum method. Oftentimes such changes are to the disadvantage of the contractor but the majority of them realize that the changes are necessary for the proper execution of the work and so much more satisfactory to them are unit prices that they prefer to do the work by this method and willingly submit to additions or deductions as may be found necessary while the work is in progress. While of course under the lump sum method changes are possible, so much is involved that only as a last resort is any change made. This is unfortunate for I venture to say that no work was ever undertaken but what during its construction it was not possible to make some alteration that would not only improve the work but also in many cases save hundreds of dollars, even more than what the total engineering expense would amount to by having the work done on a unit price basis.

I have never been able to see but one object in lump sum contracts and that is, that some one is looking to catch a sucker and in most cases one is caught. However, this monetary advantage, for that is what it is, is only temporary, for sooner or later the fortunate one becomes the unfortunate.

Great as are the advantages of the unit price contracts viewed from the engineering standpoint, much greater are they when looked at from the moral standpoint, which cannot but have a beneficial effect upon the class of work done. There is no contractor earning a living by his work but whose principal object is to make money. The word principal is used to differentiate. His first object should be to do as good work as is intended by the specifications. Careful examination of the successful contractors and those who remain so year after year will show that good work is their first object, while as a rule it is not so of those who fail. Therefore it is the duty of those engineers in charge of work to assist in every way possible to have this thought uppermost in the contractor's mind. At first this might seem to indicate a weakness on the part of contractors but after careful consideration nobody should look at it in this light and for the reason: it is the nature of many people not to do the task set before them in as careful, thorough and complete manner as should be done. In this respect contractors, and more particularly their employees, are not unlike others; therefore, any method of payment that will remove the temptation not to do good work or make it an object to do work in a careful, thorough and complete manner will not only insure the doing of all work but also in a better manner. It needs only a superficial examination of a lump sum contract to see that not only is the incentive to do faithful work absent but there is also a premium for not doing it.

Contracting today is a business representing investments of millions of dollars, in which men of honesty, ability and training predominate, whose desires are to make a fair profit on their investment and to do good work, so that whenever work is to be done near where previously they had worked their return will be welcomed by the people of that community.

Engineering today is a profession which is fast receiving from the public that credit which it should have received so many years ago, and likewise consists of capable and honest men, desiring to give their employers the best there is in them. No better means of proving these statements exists than by means of the business in which the most of us are engaged, namely highway construction. The engineer is no more responsible to the public than is the contractor, for payment for the services of both comes from the same source. Therefore it should be the duty of engineers and contractors to work together to this end, and only by a unit price contract rather than a lump sum can the first step this direction be taken, for by the former, payment is made for just so much work as is done and no more and at the same time an incentive is always at hand to do faithful work, while under the latter, payment is not equitable nor is there the incentive to do faithful work.

Conserving macadam surfaces, the maintenance of which motor traffic was making prohibitive, is being effected in Allegheny County, Pennsylvania, by using them as the base for new brick or asphaltic-concrete roads. Mr. J. S. Gillespie, county road commissioner, in addressing the American Road Congress at Detroit, stated that for brick roads the macadam is first scarified and formed to a true cross-section, concrete curbs are built, the sand cushion is placed and the brick are laid, after which the surface is grouted with a mixture of equal parts of sand and cement. In the other class of construction, bituminous concrete is laid directly upon the scarified and levelled surface, of course, and both finished surfaces are rolled. The method is said to be economical and satisfactory.

Methods of Securing Terra Cotta to Steelwork in Modern Building

By S. H. Penlington, A. R. I. B. A.

TERRA cotta is being used today in such large quantities in buildings of all kinds, from the private house to the skyscraper (which latter is commonly sheathed with this material), that a short article descriptive of the methods of fixing it in position will doubtless be of interest. First of all, there are practical limits to the sizes of the pieces used, whilst the shape also must be considered. A good working limit of size is about 2 ft. 6 ins. x 2 ft. x 1 ft., but smaller pieces are preferable, as the material shrinks about one-half inch to the foot in burning, also large pieces would show the warping and twisting more than small pieces. It is good practice to keep all the pieces as regular in shape as possible—that is to say, to have no awkward projections sticking out. This will give better results in manufacture and there will be fewer breakages in transit and handling on the job. To minimise the possibility of accident this should be done, as the re-making of these pieces in case of mishap may lead to costly delay. The manufacturer usually makes duplicate pieces, particularly of rich or delicate parts, to ensure satisfaction to his customers. Architectural terra cotta weighs on the average 70 lbs. per cubic foot. The average thickness of the material in the web is 1¼ inches and the crushing weight about 7,000 lbs. per square inch.

From the above information it will be seen that it is unnecessary to fill terra cotta blocks to add to their strength. This is done to form a bed for the work that is above, or to keep the water from attacking any steel that may be supporting the blocks. It is easier to fix terra cotta in the building than it is to manufacture it, therefore the design of the individual parts is of the first importance, the parts being designed as simply as possible and in relation to the steelwork by which they are carried. The fixing of terra cotta in a large job is done by the structural engineer, who accommodates his steel beams to the jointing of the terra cotta, putting in all necessary angles, brackets, hooks and clips.

Column Construction

Manufacturers assert that a column shaft can be made 8 ft. long in one piece with a diameter of 15 ins. Larger columns can be made up of drums not exceeding 2 ft. in diameter and about 18 inches high, fluted, as shown in sketch 1a. Column drums 3 ft. in diameter can be made if the horizontal joint is concealed by the interposition of a rusticated drum with a plain drum, but the only feasible method of jointing classical column shafts over 2 ft. in diameter is as shown in sketch 1b. Here it will be seen that the column has vertical joints. To the left of the centre line—these are shown in the flutes and to the right in the fillets—either method can be used. This method of jointing allows the fixers to "true up" the columns more accurately than could be done with large pieces, owing to shrinkage in the material. The right and wrong way of jointing small attached columns is shown in the second sketch. These drums are made 18 inches high. It will be seen at once that a piece of terra cotta as at A would crack in burning. Where the col-

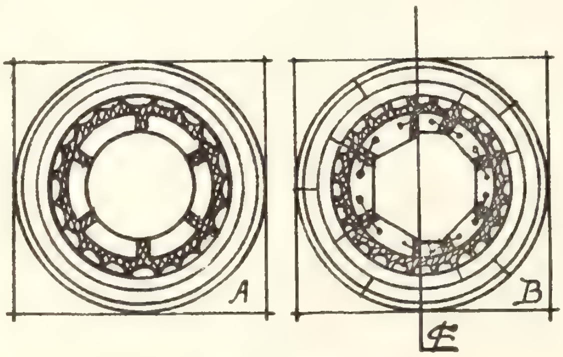


Fig. 1 (A and B).

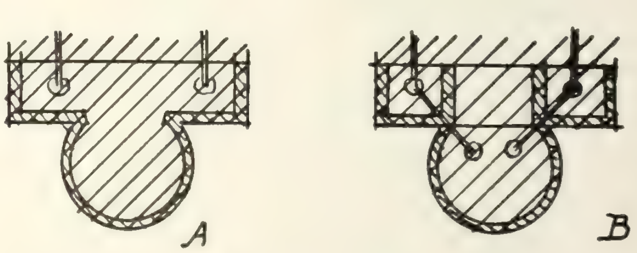


Fig. 2 (A and B).

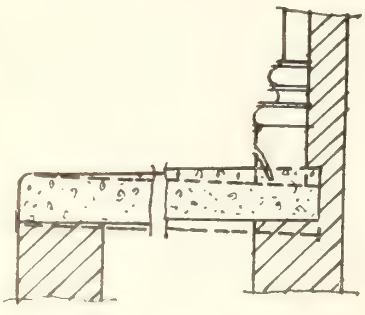


Fig. 3.

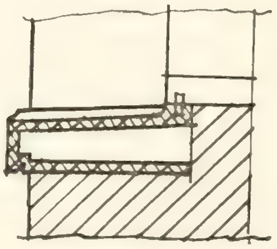


Fig. 4.

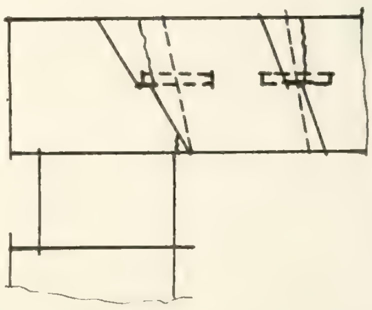


Fig. 5.

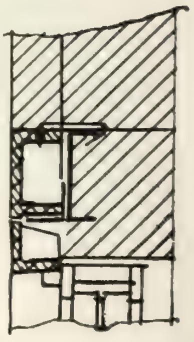


Fig. 6.

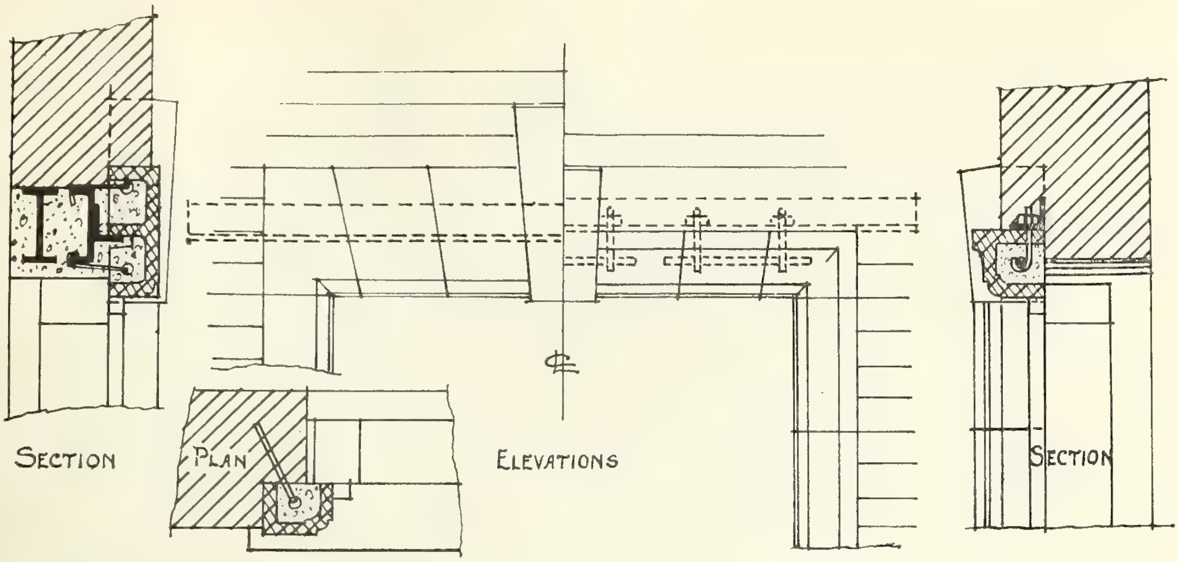


Fig. 7.

umn meets the wall face, the right method is to put a joint as at B. Sketch 3 shows the base of a pilaster resting on the sidewalk. The settlement of the building, which is bound to take place, will flash off the outer edge of the base, therefore the pilaster and the sidewalk should rest independently on the finished wall. The best method of making a window sill is shown in sketch 4. It drops away immediately from the wooden sill about 1 in. This allows the roll to cover the joint of the sill.

Sketch 5 shows a flat window head with joggle joints and the resultant cracks in the material owing to the acute angle formed in the blocks. The correct method of jointing and dowelling is shown by dotted lines.

In sketch 6 is shown a broken window head. This is caused by the shelf angle supporting the terra cotta having too much projection. The correct method is illustrated in sketch 7 and allows the terra cotta only a 2-in. bearing on the shelf angle. To the left of the centre line is another method of hanging a window head. Here the hook bolts and nuts allow a very fine adjustment of the blocks. Most suspended terra cotta is done in this way as will be seen by the following sketches. Although in this case the strength of the construction is unnecessary it is shown as an example of good work. A simple terra cotta head is frequently fixed by putting at 1½-inch pipe through the blocks. If the holes in the blocks are not in alignment they can be made so by means of a star drill. The

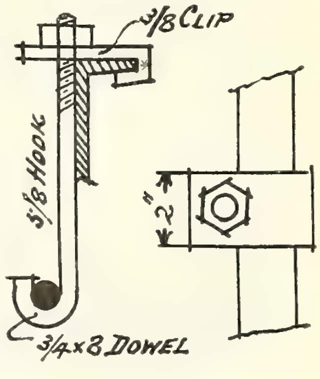


Fig. 8.

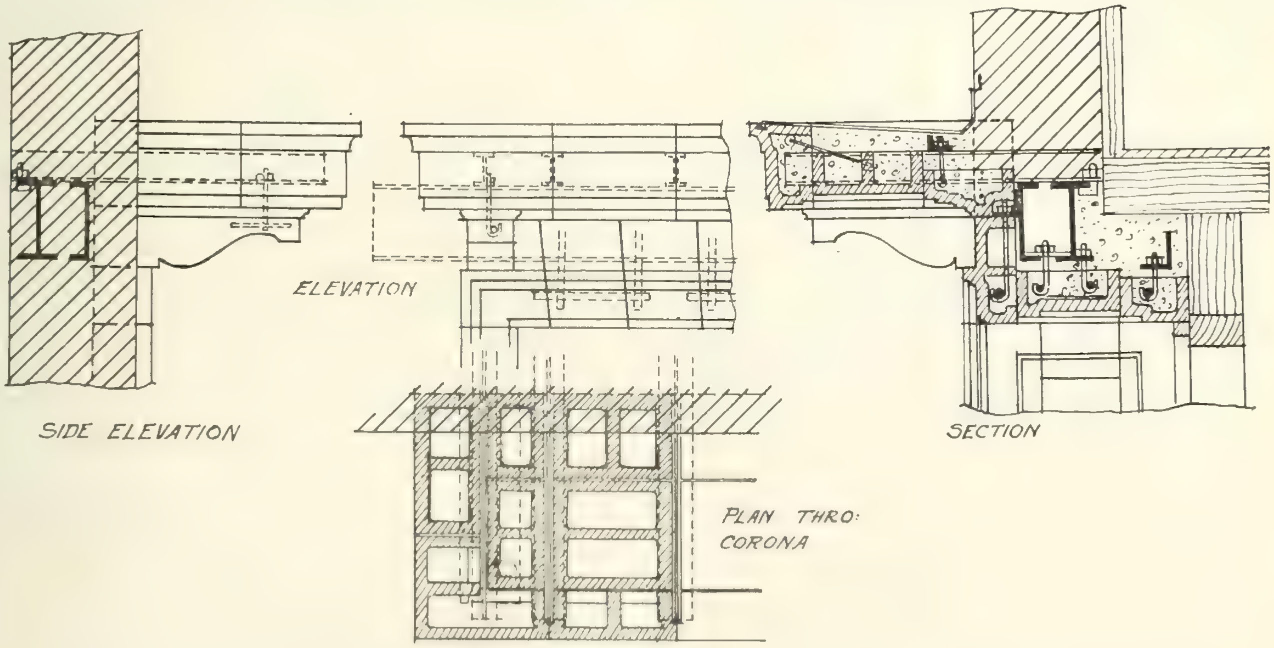


Fig. 9.

usual clip and hanger employed in suspended terra cotta is indicated in sketch 8.

Sketch 9 shows plan elevations and section of a projecting door head. The system of carrying terra cotta is capable of adjustment to suit the door head of much greater projection. The steel lookouts are so arranged as to come between the joints of the terra cotta and are tailed down to the wall beams by hook bolts. The advantage of the hook bolt here is that it may be fixed anywhere along the wall beam without drilling. The soffit panels will be lipped on to the lookouts, the bed mould hooked up to an angle across the lookouts. The members of the cornice will be hooked back to the steel as shown, and the blocks will be filled with concrete wherever possible in order to protect the steel from moisture.

Sketch 10 gives the details of construction of a cornice projecting about 2 ft. 9 ins. Here steel brackets are provided at each column or pier which carry an I-beam or channel along the front of the cornice. To this the cymatium and corona of the cornice are fixed. The modillions and panels between the piers are hooked up to angles spanning from the front beams to the wall beams. In cases where a lot of filling in the cornice will be too heavy, tees are used instead of angles to support a 2-in. tile floor on which the concrete gutter is laid, the gutter being lined with copper and let into a wraggle joint as shown. The proper method of fixing balusters and coping is shown in sketch 11. Each baluster is bolted through the channel, which latter is carried across the baluster. A small filler of terra cotta is placed between each baluster to protect the steel from the weather. The coping is then laid with a bed of stiff mortar over each baluster. The whole can be secured in line by secret clamps let into a groove provided at the joints of the coping and afterwards covered with cement.

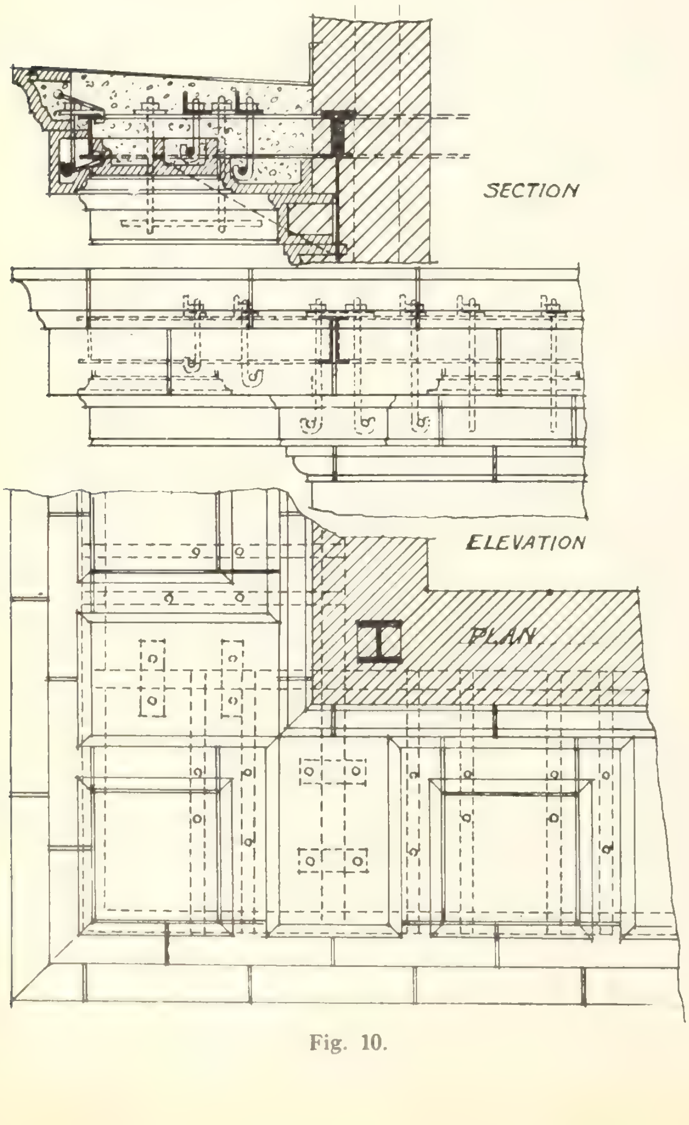


Fig. 10.

Sketch 12 shows a chimney cornice. The cornice is dropped down to allow the roll to cover the joint, the coping being carried over the flue lining in order to prevent the water from getting between it and the brickwork. A groove is made in the terra cotta and a secret clamp is let in with cement at each joint. It is very necessary to protect from water all steelwork in connection with terra cotta. To this end it is advisable particularly in suspended work to fill all the blocks with a weak mixture of fine concrete after the blocks have been fixed in position. The accumulation and subsequent freezing of the water would shatter the blocks, and the cost of replacing one piece would probably equal that of the entire concrete filling. There are places, however, where concrete could not be used; therefore, other precautions equally effective must be taken.

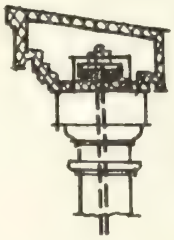


Fig. 11.

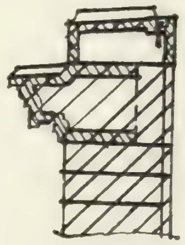


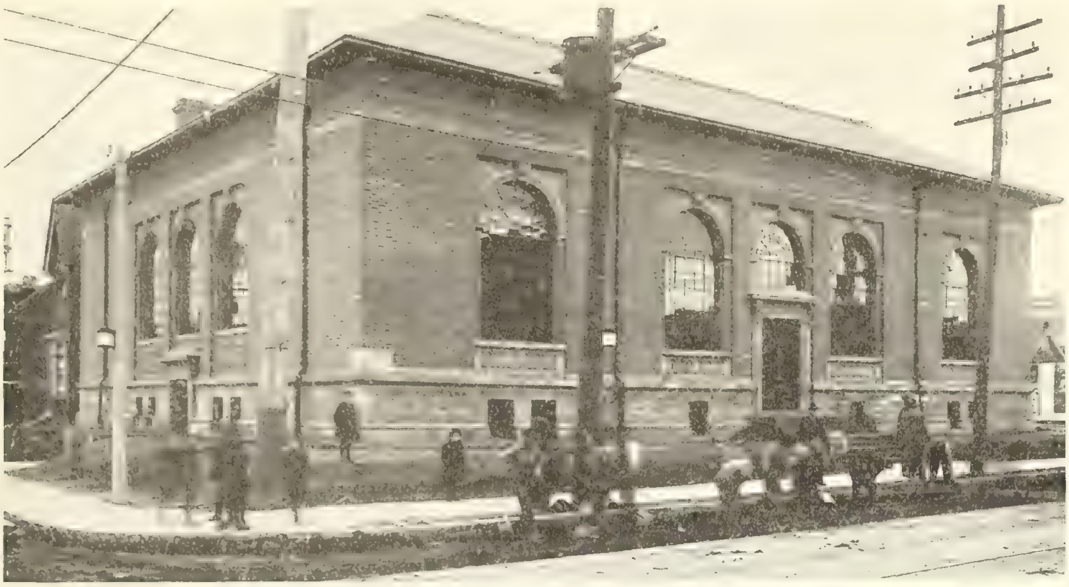
Fig. 12

In cornices of great projection the usual method is to lay a tile and concrete floor on top of the steelwork. This is done with small tees and 2-in. book tiles. The concrete is then laid above this to the necessary fall and covered with copper.

In the jointing and fixing of terra cotta a good deal of latitude should be allowed the manufacturer, who has had much more experience than any architect can possibly have acquired. The material as used to-day is quite modern, therefore any system of jointing that would prove superior to that at present in use should be adopted.

Blasting pole-holes in frozen ground has proved more economical than hand digging to the Marion Light & Heating Company, of Marion, Ind. Whenever the ground is frozen to a greater depth than 2 ft. this company digs the hole, exact size, about 15 in. deep only. With a long-handled auger a hole large enough to admit a stick of dynamite is bored about 30 in. deep. It has been found that three-quarters of a stick of dynamite will excavate a uniform hole to the desired depth of 5 ft. An average saving of 15 to 20 per cent. over the cost of manual digging has justified this method.

Nearly ninety million more face brick were produced in the United States during 1912 than in 1911, according to the annual report of the U. S. Geological Survey. The total production was 814,000,000, as against 725,000,000 for 1911. The value of the production, bulking face and "fancy or ornamental brick" was $10,707,978, which included $1,027,314 in enamelled brick, as against a value of $9,864,757 in 1911. The latter figure included $1,038,865 in enamelled brick.



The Dovercourt Branch of the Toronto Public Library.
Architects, Messrs. Chapman & McGiffin.

New Branch Library at Toronto

THE Dovercourt Branch of the Toronto Public Library is a handsome, and at the same time substantial, structure, the site on which it stands being admirably chosen for the purpose. The building, which is U-shaped, is of two storeys. The outside dimensions are 89 ft. 6 in. by 71 ft. The centre of the U is occupied by a court, 32 ft. by 30 ft., which will form a little garden and terrace, upon which the library reading room opens and through which the readers will pass to the garden and grounds at the west side of the building.

The exterior of the building is a simple treatment of a dark, red-flashed brick with buff terra cotta trimmings, depending upon the color and texture of the wall surfaces, together with the proportion of window openings, for its architectural effect. The terra cotta has been carefully chosen to harmonize well with the brickwork in color, and being a clay product it harmonizes well in character. Another advantage that is obtained in the use of terra cotta is the relatively small cost of repeating certain decorated members that are characteristic of the style in which the building is designed. This of course is an important factor when taken in relation to the use of terra cotta in structures of the kind. The style is a modern adaptation of the brick architecture used in Northern Italy at the time of the Italian Renaissance, and is exceedingly well suited to this kind of building. The lower floor, having its entrance on the east side at the level of the sidewalk, is used for the accommodation of the heating plant, the Librarian's rest-room, also kitchen and lavatory, the public lavatories, and a large room 68 ft. x 25 ft. This room has a high ceiling and is well lighted with windows on three sides. A touch of homeliness is added to the apartment by the introduction of a large fireplace at one end, a feature which will also assist in the ventilation. The object of this room is for the holding of meetings and lectures, as well as for special library work.

The main floor, which is entered from the north, about five feet above the grade level, is occupied by the entrance hall, the delivery and receiving room, and two large reading rooms, each 68 ft. x 25 ft., with a ceiling height of 22 ft. The three latter rooms, divided only by large arches and practically covering the whole area of the building, give the visitor the impression of one large open area, which is so arranged that it can be flooded with sunlight at any hour of the day. This is owing to the large windows and lofty ceilings.

The walls of the reading room are lined with bookcases, 7 ft. high, above which the stucco plaster is colored a soft, bluish green tone, up to the cornice and decorated ceiling which is vaulted and of a light ivory tone. At the end of each reading room there are large fireplaces which enlarge the comfort of the visitor and will also assist in the ventilation. The kitchen, attendance rooms, etc., are all fitted in modern style and everything that adds to convenience and comfort has been provided.

The buildings are fireproof, with the exception of the roof, and the window frames and sashes being of metal there will be a minimum amount of insurance, depreciation and consequent maintenance. The roof is covered with a non-fading green slate, the gutters, rain conductors, etc., being of copper.

The walls, which are exposed, are lined with No. 2 pressed brick, obtained from the Milton Pressed Brick Company. The falling brick was supplied by Mr. A. H. Wagstaffe, Toronto.

The library is steam heated throughout and the main floor is lighted by indirect lighting fixtures. The furniture and woodwork are of oak-stained fumed oak tone and the main floor is covered with cork matting, with the exception of the entrance halls and stairs, which are of marble.

Messrs. Chapman & McGiffin, 95 King Street East, Toronto, are the architects. The contractors for the work were:—masonry work and terra cotta, H. N. Dancy & Sons; carpenter work, Thos. Paynter & Son;

roofing, A. Matthews, Limited; plastering, Hoidge & Sons; painting, A. E. Phillips; plumbing and heating, Fred Armstrong & Company; electric wiring, Bennett & Wright; metal sashes, Henry Hope & Sons; furniture, G. E. Lindsay; cork carpeting, The T. Eaton Company.

World's Record on C.N.R. Tunnel

SHORTLY after seven o'clock on the morning of Wednesday, December 10, the two headings of the Mount Royal Tunnel of the Canadian Northern Railway were joined, and in the afternoon of the same day the first train was run through from the west portal to the Dorchester Street shaft.

The headings met at about 600 feet below the highest point of Mount Royal, the distance through the tunnel being 3 1-10 miles long. It is just over fifteen months since work was commenced, and the meeting of the headings constitutes a second record in work of this character. On June 5 last, a new record for hard rock tunnelling on the continent was made, 810 feet of heading being bored in the thirty-one working days previous. In the matter of actual number of feet of rock drilled and the amount excavated, the tunnel through Mount Royal is a world's record, while on the continent of North America a tunnel of this length has never before been built through a mountain in fifteen months. The heading is fifty per cent. larger than those of the Swiss tunnels, where the actual progress has consequently been greater.

The heading is about 8 x 12 feet and this has to be enlarged to the size of 22 x 30 feet. About one and a-half miles of this has been done, but no lining has yet been placed. The tunnel will be lined and will have a dividing wall through the centres, so that the trains running in each direction will be separated.

The work was carried on in four different directions, from the west portal towards Montreal, from a shaft at Maplewood Avenue in both directions, and from a shaft on Dorchester Street, Montreal, towards the mountain. On April 5 last, the heading starting from the west portal and that running westward from the Maplewood Avenue shaft were joined, and on December 10 the two remaining headings were completed.

The average progress was 420 feet per month in each of the two principal headings, while the gross progress since the date of the commence of the first heading was 1,100 feet per month. In No. 3 heading, running from the back of the mountain towards the city, for the six months prior to the installation of the muck handling drill carriage, the average progress was 350 feet per month, and for the six months after the installation of the carriage, 485 feet per month. Prior to the use of the drill carriage, the rock consisted of crystalline Trenton limestone, with many dykes of camptonite and nepheline syenite. Afterwards the rock was almost entirely essexite. For the past two months the progress in both headings was about 110 feet each week.

The chief engineer of the Canadian Northern Montreal Tunnel and Terminal Company is Mr. S. P. Brown; Mr. H. T. Fisher is tunnel engineer. On the eastern division the assistant engineer is Mr. J. L. Busfield, and on the western Mr. R. S. Bassett. The general superintendent of the eastern division is Mr. Edward Duffy and on the western Mr. R. Byers.

Medals have been struck to commemorate the joining of the headings.

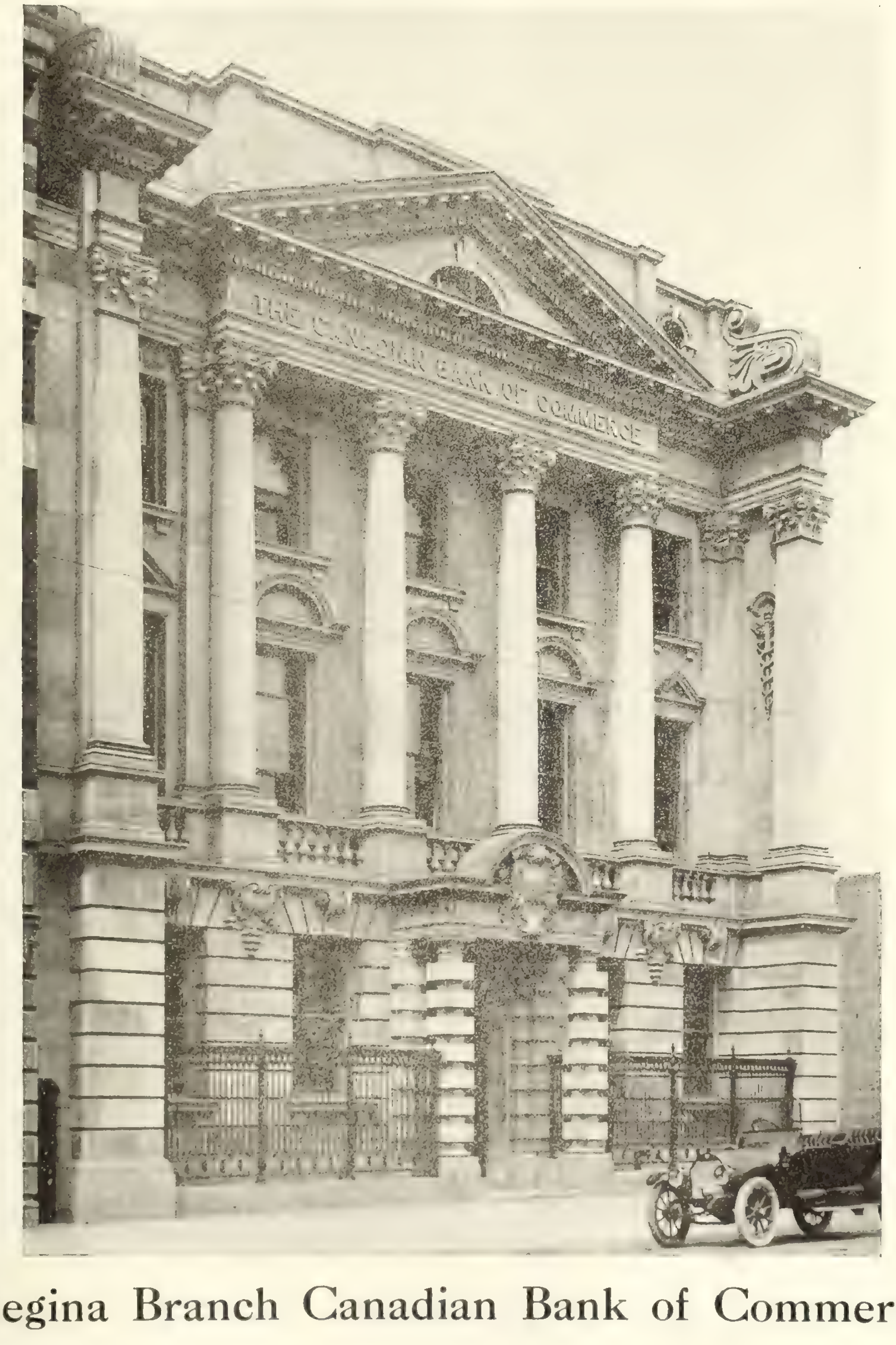
New Building of the Canadian Bank of Commerce at Regina

THE up-to-date bank building recently erected for the Canadian Bank of Commerce is a notable addition to the architectural achievements of Regina. The cut which appears on the opposite page is a striking illustration of the beauty of the building, passing reference to which was made in our issue of November 5. The massive and striking facade which now adorns Scarth Street, Regina, for many years performed the same function for the chief office of the Canadian Bank of Commerce in Winnipeg. Originally erected in 1900, being a portion of a building which in size and equipment far exceeded the need of that period, it was worthy of a prominent position in any city. The design has the quality and distinctiveness which do not go out of date, and in this respect at least the bank buildings of the Canadian Bank of Commerce may be said to be unique. The dimensions of the old Winnipeg building being no longer capable of serving the needs of that city's expanding business, much anxious consideration and careful planning were expended on the problem of preserving this structure before the happy solution was reached of re-erecting it further west where conditions of earlier development would ensure it a further term of usefulness. The new building at Regina, which is four-storeys high, is 52 ft. wide and 73 ft. deep. The banking hall is lofty and designed with more regard to dignity and simplicity than to elaboration. In size it is 46 ft. x 50 ft. The public portions are floored with marble and the counters and other finishings have been executed in mahogany with exceedingly attractive effect. In the manager's room, as elsewhere, the hardwood floor, the panelled walls and other finishings, are designed in a manner suited to the requirements of a capital city but at the same time with a careful regard to cost. The building is equipped with the ordinary steel-lined vault and in addition a treasure vault of exceptional strength has been erected. Another interesting feature of the banking hall is the quiet grey stencilled fretwork decoration on the walls, which gives a handsome touch to the general decorative effect of the interior.

The first floor of the building is arranged as rented offices and the two upper floors have staff apartments substantially furnished. Adequate provision has been made for the accommodation of the staff, bedrooms for twenty officers having been planned, as well as a sitting room 27 ft. long x 18 ft. wide. The staff has been amply provided with modern toilet accommodation, and the plumbing and sanitation have been looked after in the same manner. While the construction is steel frame internally, the solid brick enclosing walls carry their natural share of the weight. The footings are of wide spreading reinforced concrete design to distribute the weight equally over the soft subsoil.

The old Winnipeg front was originally designed by Messrs. Darling & Pearson, of Toronto, but the remainder of the structure is the work of Mr. V. D. Horsburgh, F.R.I.B.A., Toronto. The supervising architect was Mr. T. Chapman Clemesha, Regina, and the builders were Messrs. Lyall, Mitchell Company, Winnipeg.

Any sort of salt will produce a first class glaze on tile and sewer pipe, if the clay is in condition to take a glaze.



Regina Branch Canadian Bank of Commerce

Architects: Messrs. Darling & Pearson, Toronto.
Mr. V. D. Horsburg, F.R.I.B.A, Toronto.
Supervising Architect, Mr. T. Chapman Clemesha, Regina.

Contractors: Messrs. Lyall, Mitchell
Company, Limited, Winnipeg.

Glossary of Terms Used in Road Construction

(Continued from issue of Nov. 26)

Patrol Maintenance.—A term used to designate the constant supervision and consequent repair of a road.

Pave.—To make a hard, level surface with bricks, stones or wood blocks (from pavio, to beat or ram).

Pavement.—The footway, and also used to describe the finished paving of a carriageway.

Paving.—The pavement so made, or the act of doing the work.

Paving Setts.—Stone blocks used for paving carriageways.

Pavior.—One who lays the pavement. The word is also used to designate the slab or brick used for paving.

Pebble.—A small stone worn and rounded by the action of water.

Pedestrian.—A foot passenger.

Pedometer.—A pocket instrument for measuring the distance walked.

Pegmatite.—Coming under the trade name of "Granite," as settled by the Engineering Standards Committee.

Penetration Method.—Sometimes used to describe the method of constructing roads under the more familiar term of "grouting." Also used to describe a method of testing bituminous materials suitable for road making.

Penetrometer.—A machine for determining the penetration of pitches and bituminous materials.

Percussion Test.—A test of pitch, etc., by dropping a small mankey from a fixed height.

Perfecta.—The trade name of an artificial flag or stone.

Permeable.—That which admits the passage of water or other fluids.

Pervious.—Capable of being penetrated by water or other fluids.

Petroleum Pitch.—The residuum from the distillation of petroleum oil.

Petrology.—The scientific study of rocks and stones.

Phenols.—A name given to a group of oils similar to carbolic acid.

Phillipin.—The trade name of a method of carriageway construction.

Phillite.—Coming under the trade name of "Schist," as settled by the Engineering Standards Committee.

Pick.—Or Pickaxe. An instrument used for breaking up the surface of roads by hand labour.

Pinning.—Sometimes used to denote the act of making a road foundation with stones set by hand.

Pitch.—The residue of tar, etc., after heating to drive off all volatile matters.

Pitch.—Sometimes used to denote the crossfall or contour of a carriageway.

Pitch Grouting (Single).—A single layer of "macadam" grouted with a bituminous mixture.

Pitch Grouting (Double).—Two separate coats or layers of "macadam," each separately grouted with a bituminous mixture.

Pitching.—Sometimes used to designate the act of paving.

Pitchmac.—The trade name of a bituminous binder or filler.

Pit Flints.—Flints taken from pits.

Pix Process.—The trade name of a method of carriageway construction.

Plascom.—The trade name of a bituminous binder or filler.

Plastic.—Capable of being moulded.

Plate-shaped.—A term sometimes applied to flaky stones.

Pliable.—Easily bent without rupture.

Poachy.—Wet and soft; generally applied to a wet soil or a marsh.

Pockets.—Receptacles; the term is sometimes applied to depressions in the surface of a carriageway.

Pocky.—Pitted, or showing pustules on the surface.

Polygon.—A plane figure of more than four sides.

Pond.—A collection of water smaller than a lake.

Pool.—A collection of water smaller than a pond.

Porous.—Having pores or minute openings or interstices. The quality of easily passing air or water through the substance.

Porphyrite.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Porphyry.—The trade name given to a group of road-making rocks, as settled by the Engineering Standards Committee.

Potholes.—Cup-like depressions in the surface of a carriageway.

Poudrette.—Very fine powdered material.

Powder Vehicle.—Or power van. A vehicle driven by mechanical means.

Pressure Distributor.—A term applied to a machine which distributes tar, etc., on a road, to distinguish it from a "gravity distributor."

Prise.—To force or open by means of a lever.

Producer Tar.—Obtained from certain types of gas-producer plant which yield tar; not very suitable for roadwork.

Profile.—An outline or contour of the face of anything.

Promenade.—"A walk for pleasure or show." Really a place for walking, but now generally applied to broad roads or avenues, and to walks or drives at seaside resorts.

Protection Coating.—A term sometimes used to designate the top-dressing or coat of the surface of the carriageway.

Puddle.—A small collection of dirty water; clay or earth tempered with water and thoroughly worked up into a plastic condition.

Pug-mill.—A machine for mixing clay, mortar, etc.

Pulvercide.—The trade name of a dust palliative.

Pulverise.—To reduce to a fine powder by beating or grinding.

Pun.—To ram or beat earth, etc., into place.

Punner.—A rammer or beater.

Put-log.—A short piece of timber used to carry the floor of a scaffold.

Pyktonon.—The trade name of a bituminous compound.

Quagmire.—Wet, boggy land that shakes under foot.

Quarry.—A small square paving flag or brick; a place or site whence stone is obtained.

Quarters.—A term sometimes applied to the haunches or sides of a carriageway.

Quartzite.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Quenast.—The name of a Belgian granite quarry.

Quicksand.—A mass of running sand freely mixed with water.

Quickset.—A live fence or hedge.

Quoin.—An external solid angle of a building.

Rabbet.—To cut a sloping edge so as to form a lapping joint.

Rack.—To fill in the joints between stone setts or wood blocks with fine, sharp gravel or chippings before grouting.

Raddle.—A short lath or strip of wood.

Rag Bolt.—An iron pin with barbs on its shank to keep it in place.

Rammer.—A tool for heating or ramming; also called a "punner" or "beater."

Ramp.—A slope.

Random Tooling.—Hewing the face of a stone with a broad chisel, which produces a series of waves at right angles.

Random Work.—Pavement or stones set of unequal size, and not in coursed work.

Ravel.—Or Ravelling. To become untwisted or disentangled. Applied to road work, it is used to indicate the loosening or fretting up of the surface of a carriageway by the traffic.

Ravine.—A deep, narrow gorge or valley.

Raze.—To pull down level with the ground.

Recoating.—Also called "resurfacing" and "resheeting." To redress the whole surface of a carriageway with metal or a bituminous mixture. When applied to macadam roads it is called "remetalling."

Refuge.—A paved oasis or islet on the centre of a street or carriageway for the protection of pedestrians; generally raised slightly above the level of the surface of the carriageway.

Render.—To plaster directly on a surface with mortar or cement.

Residuum.—Or residuals. That which is left after any process of separation or purification.

Resilience.—"The act of leaping or springing back." Rubber has a very marked resilience.

Resilient.—The property of resilience. Bituminous compounds for road construction should, if possible, have this property.

Resin.—An inflammable substance found in most vegetables, and largely in some trees. It is insoluble in water.

Retaining Wall.—A wall constructed to support the sides of roads in embankment, or the earth or soil when in cutting.

Revetment.—A retaining or breast wall.

Rhonven.—The trade name of a system of road construction.

Rhyolite.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Riddle.—A sieve, generally constructed with wire meshes.

Ridge.—The line along which the ground slopes or descends on each side.

Rigid.—The reverse of flexible.

Rime.—Hoar-frost.

Rimer.—A boring tool.

Riparian.—Pertaining to the bank of a river. "Riparian rights" are the legal rights of landowners and others on the banks and stream of a river.

River Stone.—A term given to stones that come from the bed or the banks of a river.

Road.—"A public carriageway, with or without footpaths, but including ditches and fences"; "an open way or public passage"; "ground appropriated for travel, forming a line of communication between one city, town, or place and another for foot passengers, vehicles, cattle, etc." As a generic term the word includes highway, street, lane, etc.

Roadamant.—The trade name of a method of carriageway construction

Road-bed.—The bed or foundation on which the superstructure of the carriageway rests.

Road Crust.—The upper surface or wearing crust of a carriageway.

Road-edge.—A term sometimes employed to denote the verge or grass edge of a carriageway.

Road Metal.—See "Metal."

Roadoleum.—The trade name of a bituminous binder.

Road-stone.—A stone suitable for the construction or maintenance of a carriageway. See also "Metal."

Roadway.—See "Carriageway."

Robeson's Process.—The trade name of a system of road construction.

Rock Asphalte.—A term sometimes used to designate real asphalt.

Rock Drill.—A tool for piercing rock.

Rocky.—A term applied to a wood pavement when the blocks get loose.

Rocmac.—The trade name of a siliceous binder.

Rolley.—A truck or wagon used in mines. Hence "trolley."

Rolling.—The consolidation of a carriageway surface by rolling.

Rood.—Or rod, pole, or perch; 5½ lineal yards. A square rood equals 1,210 square yards, or a quarter of an acre.

Ropey.—Or "ropiness." The state or quality of being ropey; able to draw out without breaking, viscous and glutinous.

Rosin.—Or rubblestone. Stones of irregular shapes and dimensions.

Rubble Wall.—A wall built with rubble stones and without courses.

Runnel.—A rivulet or small brook. The word is sometimes used to designate the channel at the side of a carriageway.

Runners.—The planks placed vertically in the sides of a trench.

Running.—The act of grouting or pouring in any composition between joints, or to fill interstices.

Rut.—A term generally applied to the long depressions caused by the track of a wheel.

Rutting.—Sometimes used to designate the act of repairing ruts.

Saddle-back.—A name given to a hill when somewhat saddle-shaped, to differentiate it from a "hog's-back" hill.

Sand.—Fine particles of stone, particularly siliceous stone, in a loose state, but not reduced to powder or dust. There are pit sand, river sand, sea sand, desert sand, drift sand, etc.

Sand-blast.—A test sometimes applied to stones to test their wearing capacity.

Sandsize.—The trade name of a dust palliative.

Sandstone.—Coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Saponaceous.—Of a soapy character.

Saturate.—To cause to be completely soaked or impregnated.

Scabble.—To dress a stone with a broad chisel or "boaster" after it has been "broached."

Scale.—To separate and come away in thin layers.

Scantling.—The dimensions of pieces of timber and stones in length, breadth, and thickness. Also used as a name for small pieces of timber cut into various sizes.

Scar.—A bare and broken place in the side of a hill or mountain.

Scarf.—To join two pieces of timber by a special joint.

Scarifier.—A machine for lifting or breaking up the surface of a carriageway.

Scarify.—To break up the surface of a carriageway. Also called "chequer," "lift," "hack," etc.

Scarp.—To cut away to a slope.

Scavenge.—To cleanse from filth by brushing or scraping.

Schist.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Score.—To mark with furrows or incisions.

Scores.—Faint ruts or marks on the surface of a carriageway.

Scoria.—Similar to slag or dross.

Scoring.—See "Chequering," "Scarifying," etc.

Scrap.—A term used to designate the throwing anything aside as useless. To throw on a useless rubbish heap.

Screed.—A strip of wood or metal used as a gauge.

Screen.—A riddle or sieve, generally placed nearly upright for the purpose of screening or sifting stones, gravel, etc.

Screenings.—The refuse matter left after screening.

Seal.—To close up or imprison. Used to describe the dressing of the surface of a carriageway with some bituminous mixture or compound.

Seal Coat.—A term used to designate the final or top coat or layer of a carriageway.

Sediment.—The matter which settles at the bottom of water or other liquid.

Seep.—"To flow through pores, to ooze gently."

Seepage.—A term now applied to designate the water that has oozed through the carriageway formation on to the surface.

Seepy.—The quality of oozing slowly.

Segregate.—To separate or set apart.

Segregation.—The quality or act of separating.

Sequacious.—Ductile, pliant, manageable.

Serrated.—Notched on the edge like a saw.

Sett.—The generic term for a stone block used for paving the surface of a carriageway, sometimes spelt "set."

Shale.—Coming under the trade name of "Schist," as settled by the Engineering Standards Committee.

Shaping.—A term used to designate the trimming and preparing of any portion of carriageway construction.

Shard.—A broken piece of pottery. Sometimes called "potshard."

Sheaf.—A loose covering.

Shearing.—Coming apart, breaking by a cross thrust.

Shell.—The outer covering or casing.

Shingle.—Round, water-worn, and loose gravel and pebles.

Shoot.—Or Shute. See "Chute."

Shore.—A prop or strut.

Short.—A term applied to bituminous mixtures which have become brittle or dead.

Shoulder.—A term sometimes used to designate a haunch or side of a carriageway.

Side-cut.—A road or path breaking out of another road.

Side-edges.—Sometimes used to designate the verges of a carriageway.

Side-slope.—See "Camber."

Sidewalk.—See "Footpath."

Siding.—A term sometimes used to designate the act of keeping the sides or verges of a carriageway in repair. Used as a noun; it is sometimes employed to describe the material removed from the sides of the carriageway.

Sift.—To pass a material through a sieve or screen.

Siftings.—The residue after sifting.

Sign-post.—A direction-post at the side of a road.

Silica.—Silex or flint.

Silicious.—Sandy.

Silt.—A deposit of mud, or fine soil, or earthy sediment.

Sinuous.—Winding, or crooked, with many curves.

Skep.—A basket, sometimes called a "skip."

Skid-pan.—A shoe or drag used on wheels when descending hills.

Skin.—Sometimes applied to the top surface of a carriageway.

Slack.—Very small coal.

Slag.—The scoria from a smelting furnace; a vitreous mineral matter.

Slake.—To mix or cause to combine with water, so that a true chemical combination shall take place.

Slat.—A long, narrow piece of wood, called also a "batten."

Slate.—Coming under the trade name of "Schist," as settled by the Engineering Standards Committee.

Sledge-hammer.—The largest hand hammer used in a forge.

Slime.—Viscous mud of an adhesive character.

Slippery.—Not affording a firm foothold.

Slop-cart.—A scavenging cart.

Slopping.—A term sometimes used instead of "scavenging" to designate the act of cleansing the mud off the surface of a carriageway.

Slosh.—See "Slush."

Slough.—A place of deep mud or mire.

Sludge.—Mud, mire, dirt. Generally, however, applied to the deposit in sewage tanks after treatment or decomposition.

Sluice.—A vent for water or other liquid.

Slurry.—Very liquid mud.

Slush.—Soft mud or slush. Generally applied to half-melted snow on a road.

Soak.—To wet or drench thoroughly.

Soakway.—A term used to designate a gully pit not connected with any drain, and through which the water soaks into the surrounding soil.

Sod.—The surface of a ground filled with grass roots. A synonym for "turf."

Sodden.—Thoroughly soaked.

Softwood.—The antithesis of hardwood.

Soggy.—Thoroughly soaked. A synonym for "sodden."

(To be concluded)

Erratum.—Molten Asphalte: The definition "a thin term for 'mastic asphalte'" should read "another term for 'mastic asphalte."

It is learned in unofficial sources that the government contemplates an outlay of $500,000 in the near future on the harbor at Oshawa. An appropriation of $200,000 has already been made for this work. Over fifty acres of land has been purchased and in addition to the harbor basin of 100 feet square it has been determined to make a ship-turning basin of 600 feet square. The preliminary work has already been begun.

The docks at Nottaway, Hudson Bay, in connection with the Northern Railway line, will be built out a distance of a thousand feet where a forty-foot channel begins, and the basins between the piers will be dredged to the same depth as outside, the total docking room being estimated at five thousand feet.

An Ode to Everlasting Clay*

When Noah stood on Ararat,
His foot slipped on the slimy fat
Of Mother Earth, and I recall
Some words of his, although not all—
"The Rotten Stuff!"

He little thought that Clay met Clay,
As he went sliding on his way.
I was beneath his dignity
And got his old malignity—
"I Was the Stuff!"

Nor reck'd he that I bore the tree,
Whose branch proclaimed my victory,
O'er boundless waters of the flood:
Invited his assorted brood
"To Get the Stuff!"

His children's children, all, my cup
Have snatched and drained with bottom up;
And as they drank, unheeding they,
That maybe I was their own clay,
"Their Very Stuff."

How then, can man, whose end is mud,
Sit up and boast of his blue blood,
When all the ichor in his veins
Is but the liquor, with my brains,
"To Make the Stuff?"

I know not why, who bends the bow,
Or he who plodding wields the hoe,
Or he who rules with kingly power,
Should fill with brags his every hour—
"That He's the Stuff."

Why, I'm the feet of every man
Who treads on me, and e'en the ban
Of all his other mortal parts,
Save what eludes death's fatal darts,
"Immortal Stuff!"

Aye, there's the rub! I shape the bowl
With man's remains, but of his soul
I know naught, save it gives me mould;
I hold but dross, while it is gold
"And Priceless Stuff."

One thing I know, while round is round,
In this my own terrestrial bound,
That all of earth's own facts are mine,
And all the myriad suns will shine,
"Shine On My Stuff."

*A poem read at the Denver Session of the National Terra Cotta Society by W. E. Dennison, of San Francisco, Vice-President.

LETTERS

The Proposed Municipal Organization

Regina, Dec. 10, 1913.

Editor Contract Record:

With reference to your request for my views on the Canadian Society of Civil Engineers, I wish to state that by the correspondence I have had with municipal engineers in many parts of Canada, it would appear that a forward movement is desired.

It will be known to you that a few of us are advocating the formation of a Canadian Institution of Municipal Engineers and it is hoped to see it consummated early next year.

It must, however, be definitely borne in mind that the municipal engineers' institution will not in any way act in conflict with, but entirely supplementary to, the Canadian Society of Civil Engineers. We recognize that there must be a powerful parent organization embracing all sections of engineers and that it must be supported loyally by the engineering profession. It would be folly on our part to introduce any disintegrating forces into the Society. What we desire is to encourage it with all our power to act aggressively and decisively on our behalf.

Why then form another organization?

The Canadian Society of Civil Engineers if developed to its full power, and even now, cannot give adequate attention to municipal engineering problems. This is found to be the case in the United States, in Great Britain, in France and in Germany. Municipal engineering embraces a variety of problems and there are enough difficulties and questions arising in this single profession to keep any society fully occupied for all time. Why then hamper the Canadian Society of Civil Engineers? No other parent society has ever been able to afford time for the discussion of the multitude of municipal engineering matters without entrenching on the allied professions. Moreover, the formation of other societies has not been found to detract from the value of the parent association but rather to afford an incentive to more progress by encouraging a feeling of esprit de corps among engineers and promoting a healthy and generous competition in organization.

Canada is an immense country—a continent in size—and it must have a central government, which must be located somewhere. But throughout the British Empire whilst there are central governments there are also provincial or state governments having certain powers.

If this is necessary in civil government, can the principle be applied to engineering society organization? British Columbia engineers claim that it can. If it is possible in British Columbia, why not in other provinces?

Whilst this would mean some measure of decentralization, it would be feasible to provide for a general cohesion also.

Yours truly,

R. O. Wynne-Roberts.

Sewerage Board in the Limelight at Vancouver

Vancouver, December 5th, 1913.

Editor Contract Record:

We have read with interest your editorial and letters from contractors in regard to tendering for contracts for public works and also in regard to the treatment handed out to contractors by public boards.

A most glaring example is the manner in which the recently-appointed Board, i.e., the Burrard Peninsula Joint Sewerage Board, which was appointed to take charge of the work in connection with the sewerage for Greater Vancouver, has treated the contractors.

This Board recently called for tenders in connection with which each contractor had to fill in and return intact a priced schedule of quantities, completed in detail, and for alternative plans (comprising about two hundred items) put up cash or certified cheques, agree to put up bonds and also to forfeit his cash (not by way of penalty, but as damages) if he refused to sign the contract when called upon.

This Board turns down all tenders and to the local press gives the information that it will do the work by day labor which will be of more benefit to the unemployed of Vancouver this winter. How this will benefit the unemployed better than the work being done by contract, except by waste of public money, we fail to see. The board evidently regretted this statement, as on the following day it gave out to the press the reason "that the bids were not satisfactory."

The latter reason given is hard to comprehend, seeing that for weeks it had been stated publicly that the work was estimated to cost from $200,000 to $400,000 (a very large margin) and the tenders ran from $240,000 upwards at very close bidding. The Engineer to the Board stated that he had made no recommendation regarding the various tenders and so we fail to see how the conclusion was reached that the bids were not satisfactory.

That six firms of contractors should have their time wasted in giving out detailed prices at a cost of probably $2,000, putting up approximately $90,000 and arranging for bonds (which on the face of it looked like an attempt to get proper estimates for this work) is a gross injustice to any body of men and one of which none but a public board would be guilty.

We were not the lowest bidders and so we are not writing from any personal soreness but simply from the injustice of the whole business.

Yours truly,

"One of the Contractors."

Personal Mention

Mr. W. A. Clement, engineer of South Vancouver, has tendered his resignation to the Municipal Council.

Mr. E. A. James, C.E., Toronto, has been elected to membership in the American Society of Civil Engineers.

Mr. Patrick Welch, railway contractor, of the firm of Foley, Welch & Stewart, has been seriously ill in the Seattle Hospital recently.

Mr. W. E. Skinner, of Winnipeg, has been retained as consulting engineer for the town of Kenora, to report upon the cost of producing power at the municipality's hydro-electric plant.

Mr. John Taylor, superintendent and director, Ottawa Contractors, Limited, Ottawa, Ont., has been transferred from the class of Associate to full membership in the American Society of Civil Engineers.

Mr. John McPherson, formerly superintendent of the stores and works department in Edmonton, has been appointed secretary of the Edmonton Builders' Exchange, succeeding Mr. A. E. Wetmore, resigned. Mr. McPherson has had a wide experience in the building and allied trades, is a quantity surveyor by profession, and has acted as estimating and cost engineer on some large contracts.

Mr. A. D. Swan, formerly assistant engineer to the Montreal Harbour Commissioners, has been retained by the Federal Government to advise on the selection of a site on the eastern coast of New Brunswick, suitable for the establishment of a new port. Mr. Swan has already inspected two or three sites, and will report his findings to the government.

Mr. J. W. Porter, of the staff of the National Transcontinental Railway, has been appointed chief engineer of the Hudson Bay Railway, succeeding Mr. J. B. Armstrong, who has resigned to enter the contracting field.

Mr. W. A. Clement, Engineer to the Municipality of South Vancouver, whose resignation is announced.

Messrs. Palmer, Hornbostle & Jones, architects, of New York, have opened an office in New Birks Building, Montreal, with Mr. H. E. Prindle in charge. The firm have designed some of the largest buildings in the United States.

Messrs. George C. Diehl, of Buffalo, and Harold Parker, of Worcester, Mass., having completed their work as members of the advisory engineering board of New York State, Department of Highways, have resigned. The third member, Mr. W. de H. Washington, will continue in the service until he completes his report on his recent investigation of road conditions in Europe.

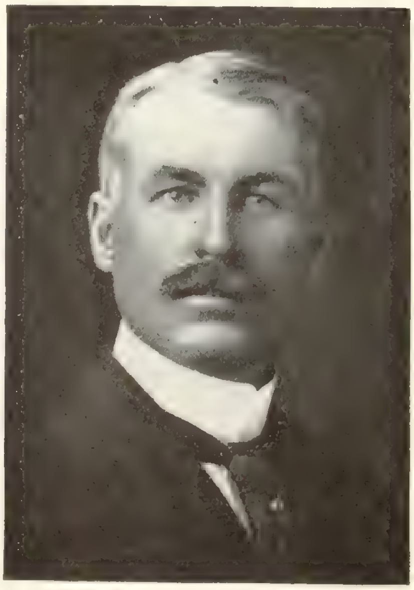
Mr. Philip H. Moore, lately mining engineer and manager of the mining, crushing and cement machinery department of the Canadian Allis-Chalmers Company, Limited, has accepted the position of general manager of the Rock and Power Machinery, Limited. The company's head office is in Toronto, with branches in Halifax, Montreal, Sudbury, Cobalt, Winnipeg, Calgary, and Vancouver.

Mr. Angus Smith has been appointed city engineer of Prince Albert to succeed Mr. Mason H. Baker who has resigned. Mr. Smith has had extended experience in the municipal field. He is a graduate of the School of Practical Science and was city engineer of Stratford, Ont., from 1900 to 1906. In the latter year he went to Regina as city engineer but resigned in March, 1910, in favor of the same office at Victoria.

Mr. H. C. Cooke, of the Geological Survey of Canada, has completed researches on Vancouver Island, and as a result of his investigations, which have been carried on since May of this year, he is able to state authoritatively that there are great prospects of copper development in certain sections, notably in the vicinity of Sooke and Ladysmith. It is anticipated that his report, while pregnant with valuable geological data, will attach particular significance to the copper-bearing regions of the Island he has come in contact with.

Mr. W. A. Clement, engineer to the municipality of South Vancouver, has tendered his resignation on the ground that the duties attached to the position are too light. The newspapers contend that this is the first instance on record where a public official has taken such a step for such a reason. Mr. Clement graduated from the University of Toronto in 1889 and was on the staff of the Toronto City Engineering Department from 1890 until 1905, when he resigned to become City Engineer of Vancouver, a post which he held for six years.

Mr. Georges Janin, who (as announced in our last issue) has made application to retire from his office of Chief Engineer to the city of Montreal.



Mr. Angus Smith, Prince Albert's new City Engineer, succeeding Mr. Mason H. Baker.

Mr. George T. Clark for the last five years City Engineer of Saskatoon, who has resigned.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

For the eleven months of this year the city of Three Rivers, P.Q., issued building permits valued at $587,800, as compared with $372,800 in 1912.

The Dominion Railway Board has granted the application of the city of Toronto for the widening by twenty feet on the east side of the proposed Yonge Street subway.

The first stretch of concrete road built in Ontario under the provincial aid system has been completed in Welland County, which has spent $58,924 on its roads system this year.

For the month of November the Montreal building permits totalled $4,293,745, an increase of $1,309,759. For the eleven months the value was $25,723,867, a gain of $15,957,281.

Hon. Adam Beck recently addressed a meeting of the Kent county council on the question of good roads as a result of which an extensive scheme for road improvement is to be prepared.

The Ontario Railway and Municipal Board has rejected the city's plan for a diagonal road through the Upper Canada College property, approving the plan submitted bu the Suidan Realty Company, Limited.

The contract for the Ashdale Avenue section of the Midway district sewerage system, Toronto, has been awarded to Mr. J. A. Jarrow for $62,500 and for the Lamb Avenue district to the Engineer of Works for $90,000.

For the first half of the year the net earnings of the Steel Company of Canada were $1,108,233, the largest for any six months' period. The figures do not take into consideration any earnings yet to be received from the new mill recently completed.

The two schemes for underground subways submitted to the Montreal Controllers by the Tramways Company and the Canadian Autobus Company have been referred to the city engineers for report. When this is received a board of experts will be appointed.

The work of preparing the site for the new union station, Toronto, is proceeding without delay, and it is expected that the whole site for the station will be cleared before the new year. The city will pass a by-law closing parts of Simcoe, Lorne, Esplanade and Harbor streets, also the York street diversion south of Front.

Plans have been drawn up by the government for the improvement of the Prince Edward Island ferry so as to insure an all-year-round service. A nine hundred thousand dollar contract for the Island terminal and one for five hundred thousand for the New Brunswick terminal have been let, together with a-half million dollar ferry boat.

H. T. Hoag, Industrial Commissioner of the St. John Board of Trade, has been in communication with a firm in another province relative to the establishment of a brick and tile plant in the city next spring. Local capitalists announce that a site has been secured, and a new brick plant will be established by them near the city next year.

The Elbram Stone Company, of Sherbrooke, P.Q., are constructing a large building for the manufacture of their products. The stone is designed to take the place of marble in public and commercial buildings, and it is claimed that the stone can be made in large slabs and in various shapes at a very much lower cost than natural marble.

When the work is in full swing upwards of four hundred men will be employed by the contractors, Messrs. Roger Miller & Sons, of Toronto, on the building of the car ferry terminals at Carleton Head, Prince Edward Island. The plant has arrived at Shediac and it is expected the contract will take upwards of three years to complete.

Mr. J. W. Weller, chief engineer of the new Welland Canal, has been requested to consider the building of concrete retaining walls in the erection of the canal through Welland. It is pointed out that unless such walls are placed along each side the town would be divided almost through the centre as the new channel is over 400 feet wide.

The Canada Cement Company recently commenced operations in one of the largest individual mills in the world situated in the east end of Montreal. Its capacity is 12,000 barrels a day bringing the total capacity of the company's plant up to about 12,000,000 barrels a year. It is computed that several million dollars have been expended on the new mill.

A report is to be prepared by the City Architect's Department regarding the cost of the new roof of steel construction for Toronto city hall. The roof of the building has been leaking seriously for some time past during heavy rain and it has been thought feasible to add another storey to the building at the present time. There is some opposition to this latter proposal, however, and the matter will be left for the incoming council to deal with.

The Ottawa city council has passed the new eight-million dollar by-law for the Gatineau Lakes water scheme. This was rendered necessary by the quashing of a former by-law which prescribed for an expenditure of five millions only. The first reading has been given in the Quebec Legislature of a bill allowing the city of Ottawa to take a water supply from any lakes in the county of Carleton, Big Whitefish lake excepted.

Mr. E. H. Bennett, of Chicago, has been engaged by the Ottawa and Hull city planning commission to prepare a comprehensive plan for the enlargement and beautification of the capital. The plan which will take two or three years to prepare will include park schemes, arrangement of governmental and civic buildings, driveways, industrial sites, etc. Mr. E. T. Cousins, engineer of the Toronto Harbor Commission will be associated with Mr. Bennett in the work.

Work on the overhead bridge at Sunnyside, Toronto, is going ahead rapidly, the last of the girders, weighing over twenty-four tons, having been put in position. The bridge is 153 feet long and 60 feet wide, nine feet of which on each side is reserved for sidewalks. The central large girder weighs sixty-three tons and the two outer ones forty-five tons each. The street car tracks will be laid on each side of the central girders leaving a roadway on each side of twelve feet.

In opposition to the plans for underground subways submitted to the Montreal Council by the Montreal Tramways Company, the Canadian Autobus Company have made an offer to construct seven to eight miles of subways at an estimated cost of $20,000,000. It is suggested that the city should build the tunnels and the company supply the plant, tracks, cars, equipment, etc. A thirty years' franchise is asked for, the city to have the right to acquire the whole undertaking at the end of that term at its actual value plus 10 per cent.

Engineers of the Toronto Works Department are working on an alternative plan for the North Toronto sewerage scheme which is expected to bring to the city a saving of something like two million dollars. The original scheme was for six million dollars and it is understood the saving will be effected by means of a different form of construction in the great water courses than was originally planned. Expensive brick work may be replaced by concrete and the scheme for manufacturing fertilizer from the disposal works discharge may be cut down.

Under a Bill introduced into the Quebec Legislature by the Hon. L. A. Taschereau, Minister of Public Works, municipalities will be called upon to contribute to the maintenance of the steel and iron bridges which the Provincial Government are constructing in place of wooden bridges. In instances where bridges are situated between two municipalities practically nothing is done in the way of upkeep, and the Bill proposes to authorize the Public Utilities Commission to decide what municipalities shall provide for the maintenance of such bridges, and what amount.

The Toronto Exhibition Board has decided to erect a number of new buildings, the most important of which is a new live-stock arena at an estimated cost of $200,000, with a seating capacity of 8,000 to 10,000 persons. The arena of the building is to be 208 feet by 370 feet, with an inside floor space of 125 feet by 225 feet. A similar expenditure is to be incurred on a new machinery hall and the remainder of the total of $600,000 is to be distributed among several other buildings and extensions. A by-law to provide the necessary funds has been adopted by the City Council.

The value of the building permits issued in St. John, N.B., for eleven months ending November 30th was $2,367,710, compared with $547,700 for the corresponding period in 1912. Despite activity in building during the past year, the housing problem is still being discussed, and is to be taken up by the Board of Trade at a general meeting to be called for that purpose. Last winter a number of immigrants who desired to remain in St. John went farther west because they were unable to get satisfactory housing accommodation and the Board of Trade is seeking to discover the best method of making the number of new, comfortable and sanitary houses at moderate rental meet the increasing demand.

The plans for this year's work on St. Alban's Cathedral, Toronto, have been brought to a successful conclusion with the completion of the entire substructure up to a height of thirteen feet above ground, including the floor of reinforced concrete. This first stage of construction was not only the most expensive but also the most difficult, involving as it did the making of foundations for all the massive piers of the nave and the extensive substructure of reinforced concrete measuring twenty feet square, for the massive columns to support the great weight of the central tower. At the present rate of construction and provided no financial difficulties occur, next year should see the edifice well on the way to completion so far as the masonry work is concerned.

Members of the Montreal Builders' Exchange have again had under consideration the Quebec Lien Law, under which supply firms can only secure a lien on the materials supplied by giving notice of responsibility for the purchase to the proprietor. The notices are sent, as a rule, in cases where the contractor is in a small way of business, and it was suggested that notices be sent out regardless of the standing of the contracting firms. A resolution has been passed requesting that all branches of the building trade, especially the supply houses, consider the advisability of uniting in an agreement to send out notifications to all proprietors with every purchase of materials amounting to $200 or over. This sum was merely a suggestion, and may be altered. The matter is to be taken up later on a report from the parties concerned.

Construction work in connection with the Halifax terminal railways is making rapid progress. The first unit of the new terminals has been awarded to Messrs. Foley Bros., Welch, Stewart & Fauquier, the contract price being $5,208,743. The work contracted for consists of a concrete landing stage 2,000 feet long, a pier 1,200 feet long and a basin 300 feet wide—built outside extensive filling in from the landing. This will give a lineal distance for shipping purposes of 6,200 feet. The work is to be solid throughout and the piers and landing stage are to be unique in their solidity and massiveness. The pier foundations will consist of 2,500 cellular blocks, 20 ft. by 30 ft., each weighing sixty tons. The cellular apertures will be filled with cement and rubble, allowance being made for uniting the blocks. Steel rails also serve to strengthen the reinforcement. The floor will be of concrete, while the front of the interior space will be faced with granite blocks from low water to the floor of the pier and landing stage.

WESTERN CANADA

Mr. James Wilson, of Chicago, and his associates will build theatres in Edmonton and Calgary and probably Moose Jaw and Saskatoon next year.

Announcement is made that a Roman Catholic high school building will be erected in Edmonton next year, and work on the first unit will begin in March.

The Ladies' Orange Association of Edmonton has plans for a girls' school to be established in this city, and Mrs. William Hoig, is head of the committee in charge.

The Edmonton city council has approved the plans for the construction of a concrete arch over Saskatchewan Avenue on Eight Street to provide a direct thoroughfare to the main entrance of the Parliament buildings.

According to returns furnished this journal by Mr. H. L. Fitzsimmons, Building Inspector, Prince Albert's building expenditure for the year up to the end of November is $1,374,390, compared with $2,034,900 for 1912.

Mr. E. F. Hutchings, of Winnipeg, owner of the Great West Saddlery, who is also interested in several other companies, contemplates erecting a six-storey brick building on Jasper Avenue, Edmonton, work to begin early in 1914.

Edmonton library board has decided to call for plans and specifications for a library building, costing $200,000, to be erected on the College Avenue site next year. The new structure will be modern, a feature being a semi-open room overlooking the river.

Mr. J. J. Rutledge, managing director of the Northern Mercantile Company at Grouard, Alta., the most northerly organized town on the continent, reports that the store building destroyed by fire the night of November 22 will be rebuilt. The structure was erected last July.

Mr. W. D. Cromarty, architect, has completed plans for a three-storey brick and stone apartment house to be erected in Edmonton for Daniel Sewell. The dimensions are 52 ft. by 113 ft. There will be 19 suites of from three to five rooms, each suite having a private bath and lavatory.

Mr. M. Valquet of the Dominion Public Works Department recently arrived at Victoria, B.C., to undertake preliminary observations looking to the improvement of the local harbors. He expects to remain on the coast for some time as his work embraces not only Victoria but also all the other harbors on Vancouver Island as well as on the mainland.

Mr. John Kirby, of Indianapolis, international president of the United Brotherhood of Carpenters and Joiners, who was in Edmonton recently reports that while building operations throughout the west are quiet, there is every reason to believe that 1914 will be a record year.

Messrs. Olson and Johnson, of Edmonton and Missoula, Mont., have been awarded a contract to construct a city market building at Edmonton at a cost of $85,000, exclusive of electrical work, plumbing and heating. There were nine bidders, one being the city's construction department.

The Bitulithic & Contracting Company, Winnipeg, have been awarded the contract for the laying of seven and a-half miles of country road near Assiniboia, Man. The price to be paid is $2.80 and $2.90 a yard, the larger amount being for the more distant portion of the road for which hauling will be more expensive.

Archbishop Legal, of St. Albert, head of the Edmonton diocese, announces that a cathedral, costing about $300,000, and a residence will be erected here next year. It is also proposed to build thirteen churches in various parts of the city. The Norwood Presbyterian congregation are to erect a $30,000 church in North Edmonton.

Two hundred and fifty thousand dollars will be expended by Mr. George Brown upon a playhouse adjoining the Empire hotel, Edmonton, of which he is a director. The structure will be of steel and reinforced concrete and modern in every detail. Messrs. Anderson, architects, are preparing plans for a building 100 x 150 feet, with a seating capacity of 2,800. The new theatre, which is being financed with eastern capital, is to be started early in March.

Plans and specifications for a new market building, including a three-storey administration section in front, for the city of Edmonton, Alta., have been completed and the contract awarded to Ohlson & Johnson. The building will cost about $50,000. Work on the foundations will commence at once and it is expected that the structure will be completed early next summer. The exterior will be constructed of red pressed brick trimmed with stone.

Mr. McIvor, building inspector, has announced to the commissioners of Edmonton that building permits, involving a total expenditure of $10,243,567, were issued during the year ended October 31, 1913, as compared with $13,217,212 for the same period in 1912. The decrease is attributed to stringency in the money market. However, several large buildings are projected, and it is expected that the total of permits issued during 1913 will be fully $11,500,000.

Arrangements have been made between the city of Edmonton and Mr. J. D. McArthur, builder and president of the Edmonton, Dunvegan and British Columbia Railway, to extend the city's water to the railway yards off St. Albert Road by means of a ten-inch main pipe line which will be connected with the city's main to 115th Street and will extend to other thoroughfares, then westerly by a six-inch pipe to the shops of the railway.

For the month of November, 27 building permits covering a money value of $51,050, were issued in the city of Regina, as compared with permits of the value of $271,670 issued for the corresponding month in 1912. The total value of permits up to November 30th, 1913, was $3,989,435, against $5,837,634 for same period of the previous year. These figures are indicative of a rather unfavorable year in the building trade in Saskatchewan.

It is reported that difficulty has arisen over the selection of a suitable site for the new dry dock at Esquimault and the matter of selection has been left in the hands of Mr. Ulric Valequette, expert supervising engineer of the Public Works Department. The new docks will be 1,150 feet long so as to accommodate the largest ocen liners. Mr. A. F. Yarrow, head of the shipbuilding firm of Yarrow & Company on the Thamas, paid a visit to Esquimault recently and inspected the shipping possibilities of the place.

In Athabasca, Alta., 1913 promises to be a record year for building. The permits up to the present total $250,000, which includes two new hotels, each of three storeys, now in course of construction. They are of brick veneer, and will install their own electric lighting plants. Messrs. Revillon Freres have announced their intention of erecting a $40,000 store and warehouse building next spring, whilst the new four-roomed solid brick school will be completed in a few weeks. The town has practically completed the installation of its waterworks system, and a company is boring a new well for natural gas.

That the city of Saskatoon, Sask., is forging ahead at an unusual rate may be gathered from the statement circulated to the effect that the building programme for the coming year will probably mean the expenditure of about six million dollars. The principal structures to be erected are an interior terminal grain elevator estimated to cost $1,000,000; new post office, $400,000; new armoury, $300,000; university extensions, $500,000; dwelling houses, $500,000; other buildings, $400,000, and a reinforced concrete arch bridge to span the Saskatchewan river, cost $400,000, which promises to be the largest of its kind in the Dominion.

The Fort Garry hotel which was opened on December 10 at Winnipeg is said to be one of the world's finest hotels, embodying in its construction the most advanced scientific and architectural ideas. This latest hotel for the Grand Trunk Pacific Company is built of Canadian granite and buff lime stone in the style of the old French chateau of Normandy and Touraine. The hotel is fourteen storeys high, the central feature of the main floor being the circular tea room of Adam design unbroken by columns, lofty in height and finely lighted by broad windows and circular dome ceiling. The structure involved an outlay of a million and a-half dollars.

Winnipeg's first commercial artificial ice plant has been erected at Norwood, Man., and is now producing ice made from artesian well water at the rate of fifty tons a day, while its daily capacity can easily be increased to one hundred tons. The actual freezing process is accomplished in a series of receptacles five feet high, 22 inches wide and 11 inches thick. The shipping room has a capacity of several hundred tons, while the storage room adjoining is capable of storing one thousand tons. The plant has been built with Winnipeg capital and is being operated by the Consumers' Ice Company of Winnipeg.

Canadian Railroad Development

The Canadian Pacific Railway Company is to be asked to build a branch line between Cranbrook and the Kootenay Central railroad.

Mr. F. A. Knapp, of Prescott, Ont., promoter of the new Canadian Transcontinental Railway from Cape St. Charles in Labrador to Dean Inlet on the Pacific Coast, visited New York recently in connection with the financing of the undertaking. The company, it is stated, will be capitalized at one hundred million dollars, and arrangements are complete for incorporation at next session of parliament.

The contractors for the Hudson Bay Railway, acting for the government will, it is stated, build an over-land railway from the end of the present grade to Port Nelson, a distance of 160 miles. It will be along the line of the roads used in lumbering operations, the object being to facilitate the taking of supplies both for the railway itself and for the Harbor terminal works at Port Nelson.

A record for the continent in tunnel building has been achieved in the completion of the Canadian Northern tunnel which pierces Mount Royal at Montreal, and enables trains to run into the heart of the city. The average progress made since the headings were started last September has been 420 feet a month and the joining of the headings was celebrated on December 9 by the running of the first train through the tunnel.

The Pacific Great Eastern expects to complete its contracts within the schedule time limits, judging by the progress made in construction work during the last six months. The section between Point Atkinson and Newport promises to be one of the most costly pieces of construction on the entire line. It will involve an outlay of about $100,000 per mile. This will mean practically laying the road on a bed of solid rock.

A suit for $1,000,000 against the Grand Trunk Railway Company of Canada for alleged breach of contract in connection with the construction of a railway terminal at Toronto, has been filed in the United States district court by Westinghouse, Church, Kerr and Company, engineers and architects, of New York. The plaintiffs set forth that they lost $1,000,000 through the railroad's alleged breach of the contract with the New York company to erect the Toronto terminal at a cost of $9,000,000.

Association and Convention Notes

The Ottawa branch of the Canadian Society of Civil Engineers held its annual dinner and smoker recently under the presidency of Mr. G. A. Mountain, president of the branch. The gathering, which was numerous, embraced men of note in every branch of engineering in Canada.

An official call for the International Good Roads Congress, to be held at the Panama-Pacific Exposition in San Francisco, February 22-27, 1915, has been issued by the International Good Roads and Automobile Association and the National Good Roads Association, of which Arthur C. Jackson is president, Maude E. Jones, secretary, and Mrs. Edward L. Murfey, treasurer. The headquarters are at the Congress Hotel, Chicago.

The second annual convention of the British Columbia members of the Canadian Society of Civil Engineers was held at the Progress Club, Vancouver, December 12-13. On Friday, December 12, an illustrated address on the Coquitlam-Buntzen hydro-electric development of the Vancouver Power Company was given by Mr. G. R. G. Conway, Chief Engineer of the B. C. E. R. and Chairman of the Vancouver Branch of the Canadian Society of Civil Engineers. Various routine business was transacted on Saturday, December 13 This was followed by a number of interesting discussions covering the education and training of engineers, the professional status of the engineer in British Columbia, and the relation of the engineer to public affairs.

The sixty-first annual meeting of the American Society of Civil Engineers will be held Wednesday and Thursday, January 21 and 22, 1914, at the society house in New York City. Three special meetings will be held on the two days following the annual meeting. The topic for discussion will be "Road Construction and Maintenance." The first meeting at 10 a.m., January 23, will be devoted to a discussion of "Engineering Organizations for Highway Work." At 2 o'clock p.m. the second sub-topic will be discussed, "Factors Limiting the Selection of Materials and of Methods in Highway Construction." The third sub-division, "Equipment and Methods for Maintaining Bituminous Surfaces and Bituminous Pavements," will be discussed at 10 a.m., January 24.

Rust-Resisting Sheets

The question of securing increased durability from sheet metal products is highly important, and one that has caused the manufacturers of sheets to devote a vast amount of time and energy. The results, we are happy to say, have proven fruitful and most practical and important developments have been accomplished recently by the American Sheet and Tin Plate Company of Pittsburgh, Pa. The outcome is the placing on the market of their copper bearing steel sheets. After careful study on the part of metallurgists, chemists and practical rolling mill people, it has been demonstrated beyond question that manufactured steel when alloyed with a certain percentage of copper, possesses remarkable durability and will resist corrosion and the action of the elements to a much greater degree than ordinary steel without copper, or those products based on alleged "purity" of the materials. The working qualities of copper bearing steel are likewise important. This material is claimed to be softer and more ductile, and experience has proven it to be more satisfactorily worked when subjected to severe drawing or forming operations. It appears quite self-evident that these copper bearing steel sheets are destined to fill a long-felt want in the sheet metal trades, especially for the manufacture of roofing, siding, gutters, culverts, tanks, car roofs, and all exposed sheet metal work, where durability and resistance to the deteriorating influences of weather and soil are highly important factors. Being made in both black and galvanized steel, the word "Keystone" alone is used as a brand for black sheets, and "Apollo-Keystone" the brand for galvanized. Messrs. B. & S. H. Thompson & Co., Limited, of Montreal, Canadian representatives of the United States Products Company, will gladly supply any metal worker or distributor in Canada with explicit information regarding "Keystone" copper bearing steel, together with a booklet containing illustrations of tests which have been conducted. It is to the interest of the metal trade to secure complete information on this important subject, since the merits of this material are being widely recognized.

Terra-Cotta and Its Proper Use as a Decorative Medium

The author of the above article, which was published in our last issue (Brick and Clay Products Number) was Mr. Philip J. Turner, F.R.I.B.A., Lecturer in Building Construction and Materials in the Department of Architecture, McGill University, Montreal. The word "Architecture" was inadvertently rendered "Agriculture."

In the description of the Port Moody Sand & Gravel plant published in our issue of November 5 last it was omitted to state that the wood stave piping was supplied by the Pacific Coast Pipe Company, of Vancouver. The firm supplied some 3,500 feet of 16-inch wood pipe for the line from the pump to the gravel pit. Much of this was for a head of 400 feet. The pipe is laid under severe conditions in places, but so far it has shown every appearance of giving satisfaction.

Mr. Michael Sinott, a pioneer contractor of the Canadian West, died recently after a very short illness. Mr. Sinnott, who was born in Wexford, Ireland in 1823, came to Canada at the age of 24 years, and settled in Winnipeg in 1876, residing there for thirty-six years. He built the first block pavement in the city, on north Main street, in 1883.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brome, Que.

Ratepayers will be asked to vote on Dec. 15th on question of taking loan under the "Good Roads Act" for purpose of constructing 20 miles macadam roads in above twp. Brome Twp. Council. Mayor, M. E. Bullard.

Galt, Ont.

Railway Board has been petitioned to have the railways build a subway at the East River Road entrance to city. Town Clerk, Jos. McCartney.

Le Pas, Man.

Ratepayers will vote on Waterworks and Sewers by-laws Dec. 16th. Mayor, H. Finger. Sec.-Treas., H. H. Elliot.

London, Ont.

Paving of City Market, King St., at a cost of $20,000, is contemplated by City Council. Mayor, C. M. R. Graham. Clerk, S. Baker. Engineer in charge, W. N. Ashplant, City Hall. 90.000 sq. yds. reinforced concrete or asphalt pavement.

Medicine Hat, Alta.

By-law re the extension and improvements to waterworks at a cost of $175,000, has been passed. H. Baker, Clerk to city council. Engineer, A. K. Grimmer.

Grading, cost $50.000, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. By-law has been passed.

By-law re sewers, cost $50,000, has been passed. H. Baker, Clerk to City Council. Engineer, A. K. Grimmer.

Montreal, Que.

Maisonneuve. Town contemplates paving 1st and 2nd Ave., Leterneau and Lasalle Sts. in spring. Sec. Municipal Council, Mr. Ecrement. Engineer, M. Dufresne, Ontario St., Maisonneuve.

Ottawa, Ont.

Water supply system, cost $8,000,000, planned by City Council. Mayor, J. A. Ellis. Engineers in charge, Sir. Alex. Binnie, Son & Deacon, St. Stephens House, Westminster, London, Eng. Duplicate tenders endorsed "Tenders for Steel Pipe," one addressed to City Clerk, Ottawa, Can., and the other to Sir Alex. Binnie, Son & Deacon, London, Eng., will be received until 4 p.m. Feb. 3rd. 1914, for about 42 miles of welded steel pipe, 54 in. internal diameter, about 32 miles of welded steel pipe, 58 in. internal diameter, and about 11 miles of welded steel pipe, 51 in. internal diameter. Forms of tender and specifications may be obtained from Engineers, in London, Eng., or from City Engineer, Arch. Currie, Ottawa, on or after Dec. 15th.

Sussex, N.B.

Sewers and water mains contemplated by City Council. Mayor, Mr. Lamb. Engineer, Gilbert Murdock, C.E. Surveys being made. Report to be presented shortly.

Toronto, Ont.

Water mains contemplated by Twp. of Scarboro. Clerk, Thomas Crawford, Agincourt. Council to lay mains on Victoria, Blantyre, Chester and Lakeview Ave. City of Toronto will be asked to supply water.

50 miles of new roadway and 6 new bridges to be constructed in York, Markham and Scarboro Twps., by York County Council. Engineer, E. A. James, 57 Adelaide E.

Committee on Works recommends extension of Willcocks St., West to connect with Ulster and Ulster West to connect with Jersey Ave. Hepbourne to be extended west to Dufferin, with 24 ft. roadway and 4½ ft. walk. Board of Control.

Vancouver, B.C.

Recommendation made to City Council by City Engineer for paving Cornwall St. at an estimated cost of $19,911.

Sewerage system. As tenders received for the construction of the Canoe & China Creek Sections of the Greater Vancouver Sewerage System, were unsatisfactory the Burrard Peninsular Sewerage Commission has decided to do the work by day labor. Clerk, Wm. McQueen. Consulting Engineer, A. D. Creer, 119 Pender St. W.

Winnipeg, Man.

Tenders received by Board until Dec. 17th for laying of sewers in the following localities: Portage Ave. from Omand's Creek to W. City limits. Talbot Ave. from Cameron St. to City limits. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

The following concrete paving is contemplated by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Lane in block bounded by Fawcett and Alloway Aves., Maryland and Walnut Sts., $2,066, and on lane in block bounded by Kingsway and Harvard Ave., Harrow and Guelph Sts., $1,712.

Water main planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Water main in McPhillips St., from Selkirk Ave. to the subway. Plans, specifications at office of Engineer.

The following sewers are contemplated by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Sandford St., $2,457; Garwood Ave., $1,477; Doreen St., $1,143; Edith Ave., $623; Warsaw Ave., $148.

Granolithic sidewalks as follows are contemplated by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Levis St., $628; Pround Ave., $821; Edmonton St., $2,620; Ellice Ave., $411; Cumberland Ave., $861; Edmonton St., $704; Smith St., $1,147; Bell Ave., $953; Wilmot Place, $1,002; Bell Ave., $972; Wardlaw Ave., $1,265; Wellington Crescent, $2,608; Stadacona St., $550.

CONTRACTS AWARDED

Ottawa, Ont.

Chlorination buildings, at Lemieux Island, cost $7,000, planned by City Council. Engineer, Arch. Currie, C.E. General contractors, Alexander & Campbell, 587 Lisgar St. Electrical, W. R. McCallum, 498 Gladstone. Additional contract awarded.

South Vancouver, B.C.

Paving, cost $438,494.93, planned by Municipal Council. Clerk, Mr. Springford, Fraser and Wilson Road. General contractors, Dominion Creosoting Co., Ltd., 198 Hastings St., W. Vancouver. Creosoted wood block pavement from 16th Ave. to River Road.

Toronto, Ont.

Sewers planned by Board of Control. General contractors, National Contracting Co., 6 Garnock Ave.—Annette St., $8,688; Edgewood Ave., $3,268. M. H. Murphy, 84 Dominion St.—Chandas Ave., $722; Elmwood, $679; Glenholme, $2,755. J. F. Connolly, 606 Avenue Rd.—Clendennan, $2,155. Grant Contracting Co., 50 Front St. E.—Dundas, $390. Routly & Summers, 47 Benlamond Ave.—Lander, $1,253. J. H. McKnight Constr. Co., 88 St. David St.—Eastern, $547.

Pavement, cost $8,348, planned by Board of Control. General contractors, Constructing & Paving Co., Confed. Life Bldg. Asphalt pavement on Rushton Rd., St. Clair to Tyrrell, transferred from Commr. of Works.

Asphalt pavements planned by Board of Control. General contractors, Constructing & Paving Co., Confed. Life Bldg., Browns Ave., $3,855; Melgund Rd., $5,489. Godson Contracting Co., Manning Chmbrs.—Curzon St., $3,360; Rose Ave., $7,791. Commr. of Works, Homewood Place and Janet Ave. Done by day labor.

Winnipeg, Man.

Paving, St. Charles, cost $246,256.30, planned by Rural Municipality of Assiniboia. Clerk, Frank Ness, Kirkfield Pork P.O. General contractors, Bitulithic & Construction Co., Empress Bldg.

Sewers, St. Charles, planned by Rural Municipality of Assiniboia. Sec.-treas., Frank Ness, Kirkfield Park P.O. Contract awarded to Dominion Constr. Co., 209 Selkirk St. Woodlawn St. and lane off Portage Ave., $8,579.35. Galbraith Co., 601 McArthur Bldg., Belvidere, Overdale, Winchester and Lindwood, $19,814.80.

Railroads, Bridges and Wharves

Beloeil, Que.

Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, who will receive tenders until 4 p.m. Jan. 5th. Plans, etc., at offices of Dist. Engineers at Post Office, Montreal, Postmaster, Beloeil, and at Dept., Ottawa.

Carleton Point, P.E.I.
Work has been started on the spur line for use of contractors working on car ferry terminal of Prince Edward Island Rly. Supt., H. McEwen. Railway engineer, Mr. Fripp. Work done by day labor under supervision of Engineer.

French River, Ont.
South Channel dam planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until 4 p.m. Dec. 29th. Plans, etc., at offices of the Dist. Engineers, Confed. Life Bldg., Toronto, Post Office Bldg., Montreal, Postmaster, North Bay, Ont., and at Dept., Ottawa. Work: placing of 3 gate sills and construction of 2 piers and abutments of concrete and steel reinforcing. This tender does not include 3 steel gates and operating machinery and steel superstructure on top of piers. These will be let by Dept. later.

Humberstone, Ont.
Tenders received by Reeve, Wm. Kramer, until Dec. 13th, for 224 ft. concrete retaining wall. Engineer in charge, Geo. Ross, Welland.

London East, Ont.
Paving of Dundas St. is contemplated by City Council. Mayor, C. M. R. Graham. Clerk, S. Baker. Engineer in charge, W. N. AsAhplant, City Hall. Market place in east end of city to be paved, 30,000 sq. yds. concrete or asphalt.

Ottawa, Ont.
Bank St. pontoon bridge planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Tenders received by Chairman, Board of Control, until December 18th.

St. Catharines, Ont.
Tenders to be called for Sec. No. 8 of Welland Canal. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Plans are about ready.

Sussex, N.B.
Station planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, British American Constr. Co., Ltd., St. John, N.B. Roofing part of station, walls up one end and foundation for the main building just completed.

Toronto, Ont.
Mimico. G. T. Rly. Co. propose building a brick station 18 x 51 on Manchester Street.

City Council have asked the Commr. of Works to report the estimated cost of a station or shelter at or near the Dufferin St. entrance ot the Exhibition Grounds.

Gerrard St. Bridge planned by Board of Control. Commissioner of Works, R. C. Harris, recommends that contract be awarded to lowest tenderer, Hamilton Bridge Co., Hamilton, Ont. Supply and erection of structural steel, $81,000.

The Dawes Road bridge is to be temporarily repaired and a new bridge constructed next year. York Twp. Council. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide E.

Vancouver, B.C.
Retaining wall and two concrete piers, each 150 ft. long by 100 ft. wide, at False Creek. Engineer, F. L. Fellowes.

West Vancouver, B.C.
Wharf additions being planned by The West Vancouver Ferry Co. Engineers, Cartwright, Matheson & Co., Rogers Bldg. Considerable dredging required.

CONTRACTS AWARDED

Glace Bay, N.S.
Dredging, cost $5,945, required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Coastal Dredging & Construction Co.

Prov. of Nova Scotia
Bridges planned by Dom. Govt. Dept. of Public Works at Barney's River, French River and West River. Sec., R. C. Desrochers, Ottawa. General contractors, Canadian Allis-Chalmers Co., Ltd., 23 Sparks St., Ottawa.

Prov. of Ontario
Four bridges, cost $90,469, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, Canadian Bridge Co., Ltd., Walkerville, Ont. Bridges on the eastern part of the Transcontinental Rly. in the Abitibi Dist., east of Cochrane.

Ottawa, Ont.
Improvements to lock No. 20, Cornwall Canal, cost $15,491, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, Kennedy Constr. Co., 136 St. James St., Montreal.

Prov. of Quebec
Bridges over Becancour River, Riviere du Sud, Riviere du Loup, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Dominion Bridge Co., Lachine, Que.

Bridge, over St. Charles River, planned by Municipal Council of Varennes. Sec.-Treas., Aime Langlois, N.P. Engineer-in-charge, L. A. Valle, 80 St. Cyrille St., Que. General contractor, Jos. Trudeau, Varennes. One span, 20 x 16.

St. Jean Port Joli, Que.
Wharf improvements, cost $7,800, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, E. Carson, L'Islet, Que. 100 x 38 x 31 ft. high.

Washago, Ont.
Dams and deepening of channel planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Jas. Roddick, 40 Wellesley St., Toronto, $8,925.

Public Buildings, Churches, Schools, etc.

Avonlea, Sask.
School planned by School Board. Sec.-Treas., T. H. Clay. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg., Regina. General contractor, W. H. Richardson. Foundations in.

Dartmouth, N.S.
Plans and specifications for proposed new school have been submitted to Board, but site is not yet purchased. Chairman, Mr. Stevens. Architect, C. R. Tohrne.

Edmonton, Alta.
School, cost $150,000, planned by Public School Board. Sec.-Treas., Mr. Brady, Mortlake Blk. Supt., Mr. Richardson, Mortlake Blk. General contractors, Read, MacDonald & Brewster, Tegler Block. Trimming interior.

South Edmonton, Alta.
Church for German Lutheran Congregation. Architect, J. P. Springer, 216 Ross St. Plans, specifications, etc., at office of Architect, who will receive tenders until Dec. 20th.

Ethel, Ont.
School, at a cost of $15,000 the School Board contemplate erecting. Sec., A. H. McDonald. White brick construction, concrete and stone foundation, maple floors, plumbing, lime and sand plastering, seating.

Fredericton, N.B.
New high school building recommended by Supt. Matter to be discussed further at next Board meeting. Board of Education. Chief Supt. of Education, Dr. Carter.

Guelph, Ont.
Collegiate institute. Board of Education. Chairman, J. M. Duff. The Board will receive plans and specifications until Jan. 15th, 1914. Three stys., structural steel and stone construction, stone and cement foundation, salte roofing, electric lighting, steam heating, maple and pine floors, plumbing, metal ceilings.

Hamilton, Ont.
School, cost $40,000, planned by Separate School Board. Sec.-Treas. Com., Father Leyes, 260 Herkimer St. Architect, Robt. Clohecy, 226 John St. S. Two storeys, 94 x 74. Plastering.

Hull, Que.
Hull French School Trustees are contemplating erecting a school.

Kingston, Ont.
Major R. W. Leonard has donated site, 850 x 350, for a residence for the students at Queens University.

London, Ont.
County Council intend purchasing electrical fittings and seating for Court House. Further information from Engineer, C. Tabot, or County Clerk ,T. Robson.

Labor temple, cost $8,000, for The Arbeiter Ring. President, Jacob Wolfe, 258 Dundas St. Architects, McBride & Gilbert, Edge Block. Plans will be ready to call for new tenders in about 2 weeks.

Montreal, Que.
The Board of Commrs. contemplate building a number of lavatories in different parts of the city. Sec., L. N. Senecal.

Mount Laurier, Que.
School, cost $30,000 for Congregation of Mt. Laurier. Priest, Father Chenier. Architect, S. J. Bigonesse, 92 Notre Dame E., Montreal. Plans about ready, tenders will be called from Mt. Laurier. 2½-storeys, 63 x 83, solid brick construction, concrete foundation, waterproofed, felt and gravel roofing, steam heating, hardwood floors, lime and sand plastering, fire escapes, architectural iron railings and stairs, seating.

Newcastle, N.B.
Court house, cost $30,000, planned by County Council. Architect, Leslie R. Fairn, Aylesford, N.S.

New Glasgow, N.S.

Town hall, fire hall and market building are contemplated by Municipal Council. Clerk, Jas. Roy.

Armoury, cost $8,000, is contemplated by Dom. Govt. Dept. of Militia and Defence. Sec., E. F. Jarvis, Ottawa.

Ottawa, Ont.

Ladies college, cost $130,000, Lyon. Architect, Allan Keefer, 229 Sparks St. Trimming interior.

Swift Current, Sask.

High school (eight rooms), planned by Board. Sec.-Treas., Arthur Webber, Box 502. Dawson, Reilly & Dawson are the architects.

St. Agathe Des Monts, Que.

Post office planned by Dom. Govt Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Finley & Gagnon, New Birks Bldg., Montreal. Tenders will be called about Dec. 15th.

St. Catharines, Ont.

Four-room addition to Alexandra School. Public School Board. Secretary, C. T. McBride. Architect, T. H. Wiley, 128 St. Paul St. Tenders received by Secretary until Dec. 29th. Plans, etc., at office of architect.

Toronto, Ont.

Addition to club building for Granite Club, 513 Church St. Architects, Curry & Sparling, 105 Bond St., who will receive tenders until Dec. 18th for all trades.

Work started on new lodge hall for Diau L.O.L. No. 2054. Sec. Bldg. Com., J. L. Bolton, 146 Hiawatha Rd. General contractors, Robinson & Morris, 226 Rhodes Ave.

Commercial H.S., cost $200,000, planned by Board of Education. Sec., W. C. Wilkinson. The Advisory Industrial Committee have approved of the draft plans. Working plans to be prepared immediately. The committee recommends that no gymnasium be erected at first. Small automatic elevator to be installed.

Vernon, B.C.

Armoury, cost $16,811, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, T. E. Crowell, Vernon. Work to be completed as soon as possible. One storey, 140 x 60.

Wallaceburg, Ont.

Sunday school, cost $13,00, for Presbyterian Church Congregation. Chairman Com., Mr. John Scott. Architect, R. W. Fawcett, 152 Essex St., Sarnia. Brick construction and foundation, new heating plant, seating, gallery. Plans are in progress.

Waterford, N.S.

School (14 rooms), Town Council. Clerk, Jas. L. McKinnon. Tenders received by Clerk until 5 o'clock Dec. 12. Plans, etc., at office of Clerk or Ronald Gillis, Sydney.

Welland, Ont.

Plans have been submitted for addition to registry office, cost $15,000, for Welland County. Clerk, Robert Cooper. Chairman, W. W. Brookfield. Architect, A. E. Nicholson, St. Catharines. Additional one storey and basement, 60 x 30, pressed brick construction, stone trimmings, fan system of ventilation.

High school, cost $60,000. Sec., W. H. Lowe. Chairman, A. J. J. Brennan. Bulk and separate tenders received by Sec. until 6 p.m. January 10th for masonry, brick, carpentry, plumbing, plastering, painting, glazing, heating, ventilating, iron stairs, galvanized iron, hollow tile and reinforced concrete, electric wiring. Plans and specifications at office of Architect, D. F. Forbes, Temple Bldg.

Winnipeg, Man.

Church of St. Michaels and All Angels. Pastor, Rev. G. H. Broughall, 611 Mulvey Ave. Present structure will be moved on to new site and plans prepared for a new church to be built later. Architect not yet chosen.

School, cost $100,000, plans are being prepared by Prov. Govt. of Manitoba. (Dept. Education). Architect, E. D. Tuttle, 701 McArthur Bldg. Two storeys, 102 x 230, stone and brick foundation, reinforced concrete and pressed brick construction, electric lighting, steam heating.

CONTRACTS AWARDED

Edmonton, Alta.

Market building, cost $110,960, planned by City Council. City Architect, A. Jeffers. Market Supt., Mr. Robertson. General contractors, Olson, Johnson Co., McLeod Bldg., at $85,00. Contract does not include plumbing, heating or electrical.

Sarnia, Ont.

Council house at the Indian reserve, cost $4,153, planned by Dom. Govt. Dept. of Indian Affairs. Deputy Supt. Gen., D. C. Scott, Ottawa. General contractor, Jos. Shank. One storey and basement, 50 x 30, concrete and brick construction.

Tecumseh, Ont.

Alterations to St. Anns' Church, cost $2,000. Pastor, Fr. Langlois. Architects, G. Jacques & Co., Windsor. General contractor, Adam Jacques, Walkerville. One storey, 16 x 20, brick and stone construction.

Toronto, Ont.

School, Kimberley St. Board of Education. Sec., W. C. Wilkinson. Heating and ventilating, Callis, Sheppard & Abbott, 279 Brunswick Ave., $690. Plumbing, Fred Armstrong & Co., Queen W., $255.

School, Shirley St. Board of Education. Sec., W. C. Wilkinson. Heating and ventilating, Fred Armstrong Co., Queen W., $8,995. Plumbing, Fred Armstrong Co., Queen St. W., $6,200. Electric wiring, Fred Armstrong Co., Queen W., $650. Heat control, National Regulator Co., 407 Lumsden Bldg., $800.

Business Buildings and Industrial Plants

Belleville, Ont.

Creamery is contemplated by Mr. M. Robinson, Guelph. The Quinte Laundry building will be altered to suit requirements. Operations to start about Jan. 1.

Digby, N.S.

Plans are in progress for the remodelling of Bank of Nova Scotia. Architect, F. Neil Brodie, 42 Princess St., St. John, who will call for tenders in a few weeks.

Ft. William, Ont.

Representatives of Plymouth Cordage Co., 55 Colborne St., Toronto, have been in Fort William looking over several sites suitable for erection of warehouse.

Ingersoll, Ont.

Theatre, $15,000, for owner and architect, Reg. Bloor. Two storeys, white brick construction, concrete and stone foundation, electric lighting, maple, pine and concrete floors, plumbing, seating. Plans drawn.

London, Ont.

Stores and apartments, cost $25,000, Central Ave and Richmond St., for H. M. Douglas, 206 Central Ave. Three stys., 74 x 40, tapestry brick construction. Architects, Wall & Blackwell, Bank of Toronto Bldg., who will receive tenders until Dec. 17th.

S. F. Lawrason & Co., Adelaide and Nelson Sts., will be making alterations to and installing new machinery in their soap factory at an estimated cost of $25,000.

Ottawa, Ont.

H. N. Bate, et al, 109 Sparks St., proposes using half a city block to build large stables. Matter to come before Board of Control.

Residence, cost $5,000, Echo and Cedar, is contemplated by T. Ballantyne, 145 Echo Drive. Work to start in spring.

Factory, cost $27,000, Nelson, projected by Crown Lithographing Co., Wellington St., has been abandoned.

Store house is contemplated by Grey & Harvey, 115 Rideau St. Iron clad brick construction, concrete foundation, corrugated iron roofing, electric lighting, pine floors.

Factory, Hintonburg, cost $125,000, for National Drug Co. of Canada, Ltd. President, J. J. Allan, c/o Allan & Cochrane, 37-39 Sparks St. Council has passed fixed assessment.

Rapid City, Man.

Plant and warehouse contemplated by Rapid City Milling Co. Vote on by-law to be taken shortly. Exemptions, etc., from taxation for 10 years.

Sherbrooke, Que.

Factory for Elbram Stone Co., is about completed. General contractors, Simoneau & Dion.

Stratford, Ont.

Factory, cost $100,000. Wood Mosaic Co., Inc., New Albany, Ind., state that nothing will be done in regard to the projected factory until spring.

Sussex, N.B.

Alterations and addition to Bank of Nova Scotia. Architect, F. Neil Brodie, 42 Princess St., St. John, who will receive tenders.

Toronto, Ont.

Plans drawn for stable for Lake Simcoe Ice Co., King and George Streets. No contracts awarded. Work may be done by day labor or contract. Two storeys, 30 x 32, frame construction, shingle roofing, electric lighting.

Garages are contemplated by the following: Mr. G. Tamblyn, 381 Adelaide W., at Queen and Lee Ave. W. W. Hiltz, 735 Broadview Ave., at 731 Broadview Ave. The Pedlar People Ltd., College and Markham Sts., at rear 679 Euclid Ave. Geo. F. James, 15 High Park Gardens.

Garage and office, cost $10,000. Owners and general contractors, Morris & VanDusen, 147 Victoria St. Constructed by day labor. Two storeys, 50 x 144, brick construction and foundation, felt and gravel roofing, gas and electric lighting, birch and concrete floors, freight elevator, galvanized iron skylights. Plans drawn.

Vancouver, B.C.

Ex. Alderman McNeill, 80 Pender St. E., contemplates the erection of a wharf and warehouse at False Creek at an estimated cost of $250,000. Work will probably start in spring.

Five stores, picture theatre and apartments, Main and Broadway, for C. M. Bowman, c/o Architect, Wm. E. Gardiner, 347 Pender St. W., who will call tenders for General Contractor about Dec. 10th. Two storeys and part basement, 100 x 100, brick facing, Monarch art stone trimmings, 5,000 sq. ft. tile and terrazzo, hot water heating.

Vernon, B.C.

Tile plant is contemplated by V. C. Morrison, Franklin, Ind. Owner may start factory for manufacture of Drain and Hollow Building Tile and Fire Roofing.

Victoria, B.C.

Site purchased, 60 ft. frontage, by McCutcheon Bros., 1309 Douglas St., who contemplate erecting stores and offices.

Windsor, Ont.

Factory, cost $7,000, factory District, is contemplated by Dowsley Spring Axle Co. Architect not chosen. Work to start in spring. One storey, 60 x 150, concrete construction, cement foundation.

Alterations to store, $8,000, for Simon Meretsky. Architects, Atchison & Adams. Tenders received by architects from Dec. 16th until Dec. 25th. Three storeys, 60 x 42, brick construction, electric lighting, steam heating, maple floors, hard wall plastering, plate glass, one freight elevator, store fronts, vaults.

Bank and offices, $150,000, for Canadian Bank of Commerce. Manager, A. E. Taylor. Architects, Darling & Pearson, 2 Leader Lane, Toronto, Ont. Brick foundation and construction. Sketches in progress.

CONTRACTS AWARDED

Brantford, Ont.

Liquor warehouse, store and office, cost $12,000, Dalhousie, for J. S. Hamilton & Co., 91-95 Dalhousie St. Architect, W. S. Jago, c/o Jago & Cole, 66 St. Paul Ave. General contractor, mason, carpenter, plastering, painting, heating, plumbing and electrical, Hugh R. Thompson, 16 Terrace Hill. Steel Hamilton Bridge Works Co., Hamilton. All brick supplied by Owners. Work to be completed June 1st, 1914. Three storeys, 12 x 33½, stone sills and brick construction, concrete foundation, felt and gravel roofing, maple, pine spruce and concrete floors, lime and sand plastering, wood lath, plate and prismatic glass, 1 freight elevator, 1 vault, plumbing.

Dundas, Ont.

Branch of Royal Bank of Canada, H. O. Montreal. Architect, J. Walker c/o Owner. General contractors, Harris & Harris, Confed. Life Bldg., Toronto. Brick and concrete construction.

Montreal, Que.

Factory alterations, Fortification and St. George, cost $30,000, for Royal Trust (for Montreal Star), St. James St. Architects, Ross & MacDonald, 1 Belmont St. General contractor, Jas. Shearer, 225 St.

Alterations to store, 330 St. Catherine W., cost $7,000. Owner, Estate G. W. Stephens, Merchants Bank Bldg. Architect, H. C. Stone, 84 St. Francois Xavier St. General contractor, Jno. Wighton, 19 Sussex Ave. Plastering, MacIntyre Plastering Co., 55 Latour St. Three storeys, 20 x 85. Subcontract awarded. Patrick. Roofing, Richardson Simard & Co., 745 Clarke St. Sub contract awarded.

Stores, Peel and St. Catherine St., cost $6,000, for Crown Trust Co., 145 St. James St. Architect, K. G. Rea, 54a Beaver Hall Hill. General contractor, C. E. Deakin, 41 Mayor.

New Westminster, B.C.

"Holbrook" Hotel addition. Agents for owners, Northwest Trust Co., 550 Columbia St. Architects, Gardiner & Mercer, Westminster Trust Block. General contractors, Jones-Cornell Constr. Co., New Westminster.

Ottawa, Ont.

Stables, etc, St. Andrew, cost $10,000, for A. E. Rae Co., Ltd., Rideau St. General contractors, Doran & Delvin, Rae Bldg. Electrical, Marchand & Donnelly, 128½ Suarks St. Additional contract awarded.

Alterations to offices, cost $5,000, for James Hill, 76 Isabella. Architects, Richards & Abra, 218-220 Booth Building. General contractor, R. A. Kemp, 149 1st Ave.

Port Coquitlam, B.C.

Hotel for H. C. Thornton, care Architects, MacKenzie & Day, Vancouver Building, Vancouver. General contractor, W. H. Mueller, 407 Hastings St. W., Vancouver, $52,000. General contractor is receiving tenders for plastering, roofing and sheet metal work. Separate tenders in for plumbing and heating, to be let later by architect.

St. Catharines, Ont.

Offices for Baldry, Yerburgh & Hutchinson. General contractor, Thos. Irvine. Steam heating plant.

Toronto, Ont.

Factory, Carlaw and Wilton Ave., cost $40,000, for Roden Bros., 99 King St. W. Heating, Nobis Engineering Co., 329 King W. Heat Control, Thermo Grade Valve System, 07 Lumsden Bldg. Subcontracts awarded.

Vancouver, B.C.

Two stores and moving picture theatre, cost $40,000, for Rex Amusement Co. President, W. P. Dewees. Architect, Phillip M. Jullien, Arts & Crafts Bldg. General contractors, Campbell & Wilkie, Crown Bldg. Alterations to building for theatre. New concrete front, ventilating system, electric lighting, theatre equipment.

Victoria, B.C.

Addition to hotel, cost $10,500, for Punnett & Williams, "Manitoba Bar," 614 Yates St. General contractors, Waddington & White, 113 Pemberton Bldg. Two storey addition, concrete constr.

Windsor, Ont.

Store and flats, cost $8,000, for Chas. Rogin. Architects, Atchison & Adams. General contractors, Bersch & Appleman. Two storeys, 70 x 34, brick veneer construction, brick foundation, felt and gravel roofing, electric lighting, stove heating, tile, oak and maple floors, septic tanks, hard wall plastering, wood and metal lath, plate glass, galvanized iron, store fronts and fixtures.

Woodstock, Ont.

Factory, cost $12,000, for Wayne Oil Tank & Pump Co., Fort Wayne, Ind., and 154 Sorauren Ave., Toronto. General manager, Mr. Diserens. Co.'s Engineer, Mr. McGuire. General contractors, McKinney Lumber Co., Ingersoll Ave. One storey, 150 x 80, cement foundation, brick construction, asbestos roofing, steel sash.

Residences

Edmonton, Alta.

Apartment house, Stoney Plain Road and 27th Street. Owner and general contractor, Daniel Sewell, Stoney Plain Rd. and Park St. Architect, W. D. Cromarty, 21 Dominion Block. Three stys., 113 x 52, 19 suites, brick and stone construction, steam heating, electric lighting. Plans drawn.

Halifax, N.S.

Apartment house, cost $5,000, for Mrs. Henry L. Warr. Builder and general contractor, G. J. Hilchey, 287½ North St. 2½ storeys, 27 x 54, cement foundation, frame construction, shingle roofing, electric lighting.

Hamilton, Ont.

Alterations to apartment house, cost $8,000, Victoria Ave. S., for C. B. Webber, 3 Stinson St. Architects, Watt & Blackwell, Lister Chambers. Three storeys, brick construction, stone and concrete foundation, gas and electric lighting, pine floors, plumbing, lime and sand plastering. Plans in progress.

London, Ont.

Residence, cost $6,000, contemplated by Mrs. E. S. Prentiss, 534 Dundas St. Two storeys, red pressed brick construction, concrete and stone foundation, slate roofing, gas and electric lighting, steam or hot water heating, oak, maple and concrete floors, plumbing, lime and sand plastering, plate glass.

Montreal, Que.

Residence, cost $8,000, for J. W. Brown, 65 Summerhill Ave. General contractors, Archambault & Conway, 332 Bleury. Elec., Elec. Repair & Construction Co., 317 Craig W. Two stys., 25 x 50. Additional contract awarded.

Residence, cost $24,000, Outremont (Bloomfield). Owner and general contractor, T. Forest, 131 de L'Epee Ave. Architect, J. E. Branchaud, 218 Chatham St. Mason and brick, Mr. Dominique, 360 St. Antoine. Carpenter, Mr. Lagauchetiere, care general contractor. Additional contract awarded.

Residence, cost $23,000, Westmount (Carleton). Owner, J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. Roofing, Richardson Simard & Co., 745 Clarke. Elec. McDonald & Wilson, 99 Drummond St. Architect still open to receive tenders for plastering.

Ten residences, cost $25,000, Lachine (Summerlea Ward), for Marcil Trust Co., 180 St. James St., Montreal. Architect, Mr. Harris, care owner. Tenders will be called about January 1st for general contract. Concrete foundation, frame construction, shingle roofing, hot water heating, hardwood floors, lime and sand plaster. Plans in progress.

Fifty cottages, cost $150,000, Notre Dame de Grace (West Hill Ave.). Owner and general contractor, Henry Gaffney, 204 St. James St., who wishes tenders on carpentry work at once, also electrical, plumbing, heating, painting and plastering.

Ottawa, Ont.

Residence, cost $5,000, contemplated by T. Ballantyne, 145 Echo Drive. Work to start in spring.

Residence, cost $5,000, for T. J. Lyntel, 43 Melgund. General contractor, R. A. Kemp, 149 First Ave. 2½ storeys, 28 x 32, brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch and pine floors, water heaters, lime and sand plastering, built-in fireplaces.

Residence, cost $7,000, Goulbourne, for L. Petergorsky and J. S. Wilson, 256 Kent. Plumbing, Goldrey & Chapman, 358 Rideau St. Additional contract awarded.

Toronto, Ont.

R. Dale, 16 St. Andrews Gardens, has just purchased a site for the erection of a residence.

S. H. Taylor, Runnymede and Henrietta St., who is building 10 pair residences, will receive tenders for carpentry work, labor and material.

Lake Simcoe Ice Co., 178 King St. E., will build apartments on top of present office building. Plans, etc., on view at 78 Dupont St. Tenders to be sent to 178 King St. E.

Seven pair residences, cost $32,000, Pendrith. Owner and general contractor, J. M. Walkey, 326 Shaw St., who will superintend. Two storeys, 33 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Two detached residences, cost $6,000, Gothic Ave. Owner and general contractor, S. B. Green, Weston, Ont., who will superintend construction. 2½ stys., 20 x 40, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Two detached residences, cost $5,000. Owner and general contractor, C. S. Townsend, 149 Redpath Ave. Two storeys, 20 x 40, brick construction and foundation, shingle roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Two pair residences, cost $8,000. Owner and general contractor, W. J. Spence, 118 Symington Ave., who superintends construction. Two storeys, 33 x 42, brick construction, concrete foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak & spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Two pair residences, cost $8,000, Laughton Ave. Owner and general contractor, A. A. Larkin, 112 Laughton Ave. Two storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

One pair residences, cost $5,000. Owner and general contractor, W. J. O'Reilly, 52 Colborne St., who will superintend. Two storeys, 34 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Winnipeg, Man.

Isaiah C. Craig, 165 Lipton St. will erect 20 to 40 houses on 900 acres of land in Blocks 42, 43 44 St. Francis. Land to be divided in small market gardens complete with buildings. Owner desires to get in touch with contractors who are willing to build these houses. Work to start in spring.

CONTRACTS AWARDED

Windsor, Ont.

Residence, cost $6,000, for Dr. A. E. Bowman. Architects, Leybourne & Whitney. Mason, John Ferguson. Carpentry and roofing, Elmer Gignac. Plastering, Lockwood & Troup. Heating and plumbing, Windsor Hardware Co. Electrical, A. H. Cook. Two storeys, 31 x 33, brick construction.

Power Plants, Electricity and Telephones

Aurora, Ont.

As hydro-electric lighting is being installed in town, many of the house will require wiring. Address all inquiries to Mayor, W. J. Baldwin.

Galt, Ont.

Town council, Clerk, Jos. McCartney, contemplates erecting ornamental lights on Water St. north and south.

Le Pas, Man.

Ratepayers will vote on Electric Lighting by-law Dec. 16th. Mayor, H. Finger. Sec.-Treas., H. H. Elliott.

London, Ont.

London & Port Stanley Railway Board are purchasing equipment for line between London and Port Stanley, cars, rails, machinery, wire, etc. Engineer in charge, S. B. Storer, care Hydro-Elec. Commission, Toronto.

Medicine Hat, Alta.

Extension to power and electric lighting, $150,000, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. By-law has been passed.

Newcastle, N.B.

Wireless station for Universal Radio Syndicate. General contractors, Galbraith & Cate, 179 St. James St., Montreal, Que. 450 x 55, 105 x 35, is nearing completion. Power house also about completed. Concrete and steel construction.

Ottawa, Ont.

Boiler and engine house, cost $12,000, Middle St., for Ottawa Electric Railway Co., 248 Albert St. Steel for roof, P. J. Powers Co.; Ltd., 224 Bridge St. Boilers, generators, etc., Canadian Westinghouse Co., Hamilton, Ont. 90 x 71, solid brick construction. Walls going up.

Preston, Ont.

Ratepayers will be asked to vote on by-law January 5th, to grant renewal franchise to Galt, Preston & Hespeler Street Railway Co., Ltd., for term of 25 years. Company to make extension to present system.

South Vancouver, B.C.

The Board of Works has authorized the installation of the Gamewell Fire Alarm System at a cost of $10,375. Clerk, Mr. Springford, Fraser and Wilson Rd. Electric Engineer, Mr. Rawder.

Toronto, Ont.

Ontario Hydro Elec. Power Commission are preparing plans for new line from Niagara Falls to Dundas, $500,000, To be built in private right of way, new towers and cables. Chief Engineer, F. A. Gaby, Continental Life Building.

Welland, Ont.

Fire alarm system, cost $5,000, is contemplated by Town Council. Clerk, C. M. Webber. By-law to be voted on next month.

Winnipeg, Man.

Switching apparatus required by Bd. of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King Street. General contractors, Northern Electric & Mfg. Co., 599 Henry St., at $9,550.

Telephone System. Manitoba Government Telephone Commission will receive tenders until noon, Dec. 12th, for supply of telephone instruments for delivery in the year 1914. Full information at office of chief engineer, Charlotte Street.

CONTRACTS AWARDED

Collingwood, Ont.

Electrical equipment for Imperial Steel & Wire Co. General contractors, Canadian Westinghouse Co., Hamilton, Ont. Motors, transformers and equipment.

Hamilton, Ont.

Sub-station, $19,088, Dundurn Street, planned by City Council (Hydro-Elec. Dept.). Mayor, John Allen. Consulting Engineer, E. I. Sifton, City Hall. Architects, Watt & Blackwell, 125 Lister Chambers. Elec. machinery and equipment, Canadian Westinghouse Co., Ltd. Two storeys, steel and brick construction, concrete foundation. Additional contract awarded.

Victoria, B.C.

Telephone line, cost $10,650, for City Council. Water Commissioner, C. H. Rust, City Hall. General contractor, Thomas Watson. Line required in connection with Sooke Lake waterworks extensions.

Miscellaneous

Guelph, Ont.

City Council require two chemical tanks. Mayor, S. Carter. Clerk, T. J.

(Continued on page 73)

Tenders and For Sale Department

TENDERS

FOR

A Complete Mechanical Filtration Plant, Boilers, Steam Turbo-Generator Plant, and all Appurtenances

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, January 20th, 1914**, for the installation of a complete Mechanical Filtration Plant, Boilers, Steam Turbo-generator Plant, and all appurtenances at Toronto Island.

Specifications and tender forms may be obtained upon application at the office of Mr. James Milne, Mechanical and Electrical Engineer, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or, in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
November 25th, 1913. 49-51

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dam on French River, South Channel, Ont.," will be received at this office until 4.00 p.m. on **Monday, December 29, 1913**, for the construction of a Dam across the South Channel of the French River, at head of Big Chaudiere Falls.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont.; Post Office Building, Montreal, and on application to the Postmaster at North Bay, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 5, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51842. 51-52

Tenders Wanted

Lump sum and separate tenders for the following trades: Mason and Bricklayer, Carpenter, Plumber, Plasterer, Painter and Glazier, Heating and Ventilation, Iron Stairs, Galvanized Iron, Hollow Tile, and Reinforced Concrete, Electric Wiring; for the erection of a new High School, will be received by the High School Board, Welland, up to 6 p.m., **January 10th, 1914.**.

Address all tenders to Mr. Wm. H. Lowe, Secretary.

The lowest or any tender not necessarily accepted.

Plans and specifications may be received upon application to the Architect, D. F. Forbes, 43 Temple Building, Welland.

51-52

Sealed tenders addressed to the undersigned, and endorsed "Tender for Submarine Cables," will be received at this office until 4 p.m. on **Thursday, the 15th of January, 1914**, for 10 knots of gutta-percha cable with 4 conductors and 14 knots of gutta-percha cable with 2 conductors, to be delivered at Halifax, N.S., or St. John, N.B., by the 1st of May.

Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51974. 51-52

STEAM PUMPS

Sales agents for Canada are wanted by one of the world's largest manufacturers of steam pumps. Only firms with high class connection will be considered. Apply Box 924, Contract Record, Toronto. 51-53

TENDERS

FOR

Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 16th, 1913.**

1. Asphalt (Refined).
2. Paving Blocks (Vitrified).
3. Granite or Stone Setts.
4. Treated Wood Blocks.
5. House Numbers.
6. Iron and Steel.

Specifications and tender form for any of the foregoing, may be obtained upon application at the Accounting and Purchasing Section of the Department of Works, Room 12, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders, the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto, Dec. 1, 1913. 50-51

FOR SALE

Steam Driven Air Compressors

thoroughly refitted

One 1,000′ Machine, Duplex Type, Compound Steam, Compound Air.

One 1,200′ Machine, Duplex Type, Compound Steam, Duplex Air.

For particulars and prices write

The Jenckes Machine Company

SHERBROOKE, QUE.

Montreal Office, - - - - - E. T. Bank Building

50-53

Extension of Time

Notice is hereby given that the time for the reception of tenders for the construction of wharfs at Victoria Harbour, B.C., is extended to Thursday, January 8, 1914.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 9, 1913. 51

Canadian Pacific Railway Company

North Toronto Grade Separation

Notice to Contractors

Sealed proposals will be received by the undersigned up to 12 o'clock noon on **Saturday, December 27th**, for furnishing labor and material in connection with the waterproofing of eight subways at North Toronto.

Plans and specifications may be seen at the office of the Engineer of Grade Separation at No. 262 Avenue Road, Toronto, where proposal forms may also be obtained.

The lowest or any tender not necessarily accepted.

B. RIPLEY,
Engineer of Grade Separation.
Toronto, Dec. 4th, 1913. F

City of Ottawa, Dominion of Canada

Tenders for Steel Pipes

Sealed tenders in duplicate addressed one copy to the City Clerk, City of Ottawa, Canada, and the other to Sir Alex. Binnie Son & Deacon, St. Stephens House, Westminster, London, Eng., and endorsed "Tenders for Steel Pipes," wil lbe received until 4 p.m. on **Tuesday, the 3rd day of February, 1914**, for about forty-two miles of welded steel pipe, fifty-four inches internal diameter, about thirty-two miles of welded steel pipe fifty-eight inches internal diameter, and about eleven miles of welded steel pipe, fifty-one inches internal diameter.

Forms of tender and specification may be obtained from Sir Alex. Binnie Son & Deacon, St. Stephens House, Victoria Embankment, London S.W., or from the City Engineer of Ottawa, Canada, on and after the fifteenth on receipt by them of a cheque to the value of five hundred dollars made out to the City Treasurer of the City of Ottawa, Canada, which sum will be returned on receipt of a bona fide tender.

The lowest or any tender is not necessarily accepted.

No tenders will be considered except from actual manufacturers capable of supplying the whole of the pipes within a period of two and a half years from the date of acceptance of the tender.

SIR ALEX. BINNIE SON & DEACON,
Engineers in Chief,
St. Stephens House,
Westminster, London, Eng.
Dated December 4th, 1914. 51-52-53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharfs and Dredging at Rimouski, Que.," will be received at this office until 4 p.m., on **Monday, December 22, 1913**, for the construction of a line of Wharfs and Dredging Tidal Basin at Rimouski, County of Rimouski, Que.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Rimouski, Que.; Post Office Building, Quebec; Post Office, St. James St., Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43493. F

Representatives Wanted

Large firm manufacturing gravitation and pressure filters wants to secure reliable representatives for Canada. Successful installations in all parts of the world. Apply Box 923, Contract Record, Toronto. 51-53

Engineering Salesmen

Good future offered to a few clean-cut Engineering Salesmen, technical graduates preferred, to act as outside representatives for an established Consulting, Engineering and Construction Corporation, based on co-operative plan. Offices in Cleveland, Detroit, Buffalo and New York City. Highest references and financial interest required. Contract with salary, commission and expenses guaranteed. Answer Box 922, Contract Record, Toronto. 51

Miscellaneous

(Continued from page 71)

Moore. Chairman Fire and Light Com., H. O'Connor.

Guelph, Ont.

Fire escapes to be purchased for three schools. Chairman Board of Education, J. M. Duff, Oxford St. Sec., Wm. Tytler, Paisley St.

Hamilton, Ont.

Crushed stone required by Board of Control. One year's supply of broken stone awarded to Canada Crushed Stone Corporation, Ltd. 1, 2 and 3 in., at $1 per ton, 2-in. crushed run at 90c per ton, screenings at 60c per ton.

Harrow, Ont.

Council has ordered gasoline fire engine from the West Lorne Fire Engine

CASTINGS
Gardner & Saxby
Engineers' Patternmakers, etc.
346 5th Ave. W., Vancouver, B.C.

The
Laurentian Granite Co.
Limited
Manufacturers of
Building Granite, Granite Setts, Curbing, Crushed Granite
Samples Furnished and Prices Quoted on Application
Rose and Pink Granite Quarries at Staynerville, P. Que., Co. Argenteuil, on C.P.R.
Bank of Ottawa Bld'g, 224 St. James St. Montreal
Bell Tel. M. 4354

Power & Son,
Architects and Building Surveyors
Merchants Bank Chambers,
Kingston, Canada

Geo. M. Miller & Co.
Architects
Toronto General Trust Building TORONTO

Canada Lumberman & Wood Worker
Toronto, Canada

Co., and contemplates purchasing 2½-in. hose and other equipment.

Lindsay, Ont.
Slab-slasher and lath machines being installed at The John Carew Lumber Co., Ltd., sawmill, William St., and boilers may be required.

London, Ont.
Board of Education, Sec., R. M. McElheran, contemplating steam heating plant, cost $20,000. Further information from secretary or A. M. Hunt, care Western Fair Board, Dom. Savings Bldg., and E. R. Dennis, care Dennis Wire & Iron Works Co., Ltd., 22-26 Dundas St. Isolated steam heating plant and fittings for 30-room college building, new ventilating system.

Midland, Ont.
Chew Bros. will replace their present equipment of 5 boilers with new ones. General repairs to be made to plant.

Montreal, Que.
Motor fire apparatus required by Board of Commrs. Sec., L. N. Senecal. Fire Chief, J. Tremblay, 20 Craig St. W. Tenders received were unsatisfactory. New tenders may be called.

Ottawa, Ont.
Submarine cable required. Dom. Government, Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received until January 15th, 1914, for 10 knots of gutta percha cable with 4 conductors and 14 knots with 2 conductors, to be delivered at Halifax by May 1st. Specifications at office of General Superintendent of Government Telegraph Service, Ottawa.

Quebec, Que.
Heating and ventilating in post office required by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, who will receive tenders until January 8th, 1914, Plans, etc., at offices of Chas. Chapais, Dist. Engineer, Quebec; R. L. Deschamps, Overseer Public Buildings, Post Office, Montreal, and at Department, Ottawa.

Seaforth, Ont.
Creamery equipment required by Johnson & Barber. Building has been purchased; owners contemplate installing creamery equipment; also equipment for the manufacture of cheese and ice cream.

Toronto, Ont.
Tenders received until Dec. 16th. Specifications, etc., at Room 12, Purchasing Dept. Annual supplies. six iron and steel, seven special castings. Board of Control. Mayor, H. C. Hocken.

Wallaceburg, Ont.
Wallaceburg Brass & Iron Mfg. Co., Ltd., Wallace St. Manager, D. A. Gordon. Machinery and equipment required for the manufacture of electric irons, etc.

CONTRACTS AWARDED

Montreal, Que.
Motor fire apparatus required by Bd. of Commrs. Sec., L. N. Senecal. Fire Chief, J. Tremblay, 20 Craig St. West. General contractor, W. E. Seagrave, Walkerville, Ont. Hose wagon and ladder truck, $21,650. General contractor, A. Jennings & Co., Wellington Street, Montreal, salvage wagon, $7,000.

Water tank for Maisonneuve Municipal Council. Secretary, Mr. Ecrement, Town Hall. Engineer, Marquis Dufresne. General contractor, T. Belair, 1835 Ontario E. To supply water tank for public market.

Business Notes

Amherst, N.S.
Factory of Canadian Beverage Co., Ltd., Spring St., destroyed by fire. Damage to building and equipment, $20,000. Frame construction, stone foundation.

Premises of H. G. Hagen, destroyed by fire, insurance $3,500. Loss covered. Occupants, F. D. Stanton, restaurant, insurance $2,200, loss covered. Rae G. Barker pool room, equipment all destroyed, insurance $2,200, loss covered.

Bedford, Que.
Plant of Bedford Mfg. Co., Bridge St. Manager, F. D. Walsh. Forge room, tempering shop, finishing and machine shop, coal sheds and stables destroyed by fire, also machinery. Loss about $75,000, insurance $25,000.

Brantford, Ont.
Fire at Bow Park Farm, property of Dominion Canners, Ltd. Manager, Otto Herrold, Bow Park Farm P. O. Barn destroyed, 250 x 50, also impliments. Loss $50,000; insurance $154,000. Will probably rebuild.

Kingston, Ont.
Liquor store of James McParland, 341 King St., destroyed by fire. Damage estimated at $10,000.

You Can Interpret the Code Instantly with McLoughlin's

Questions and Answers
on the
National Electrical Code

It tells at once the answer to the questions on code requirements.
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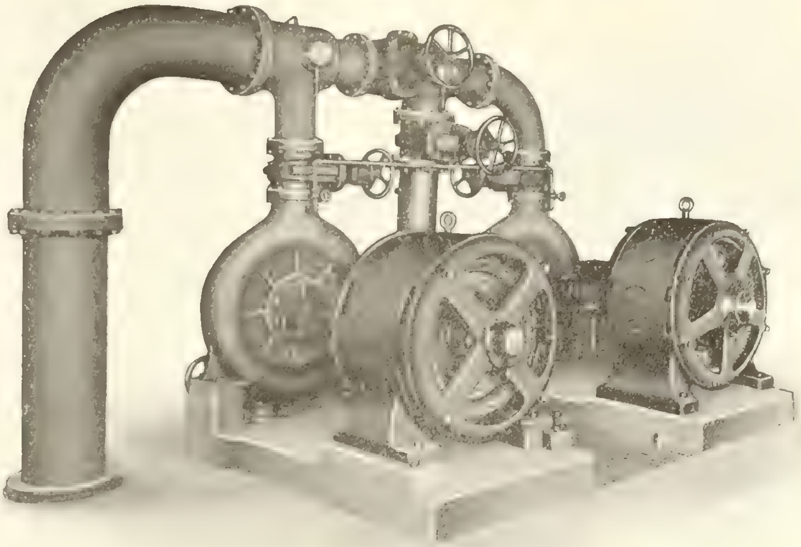

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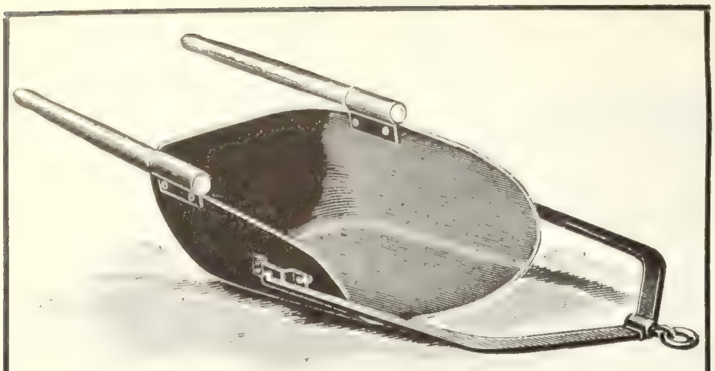

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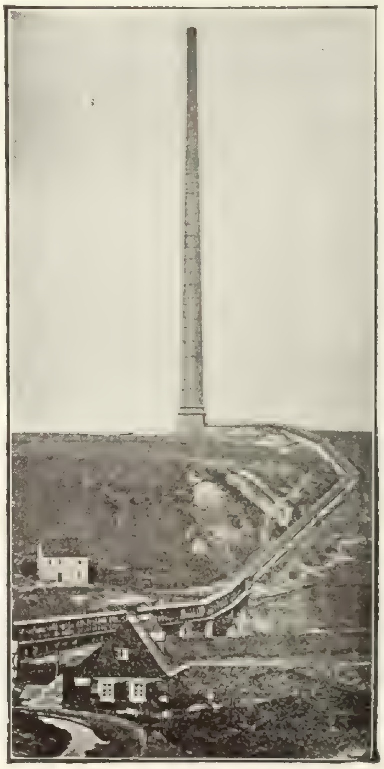

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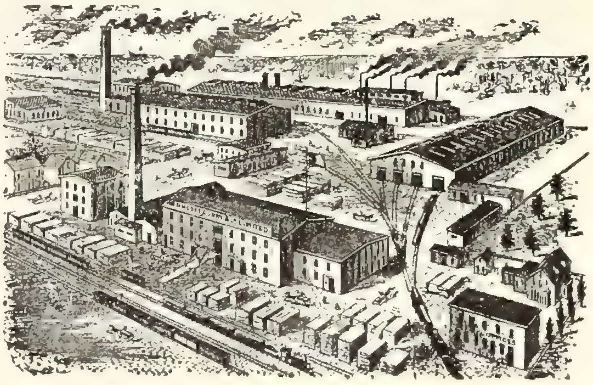

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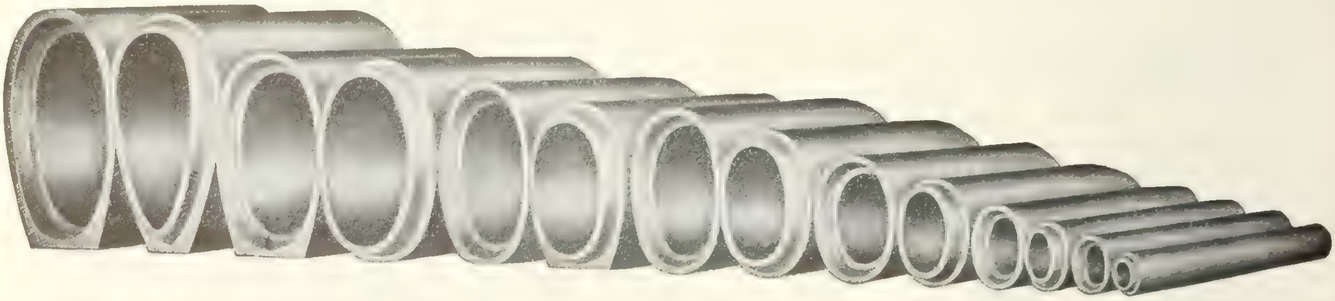

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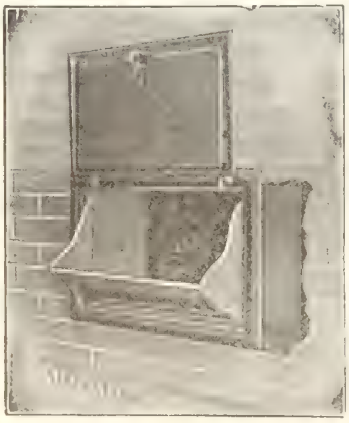

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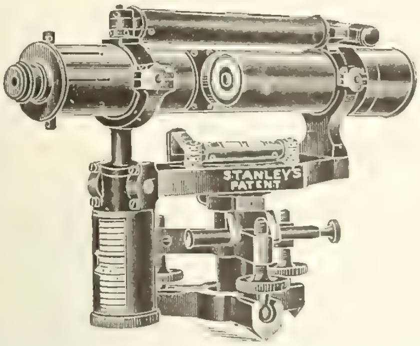

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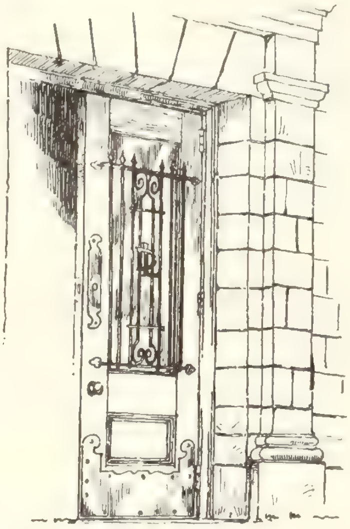

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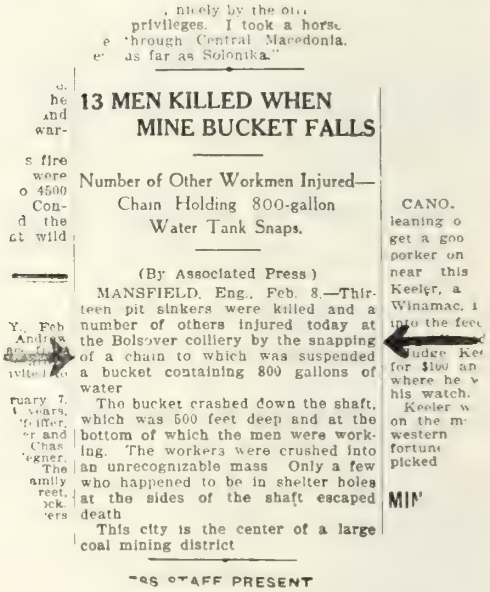

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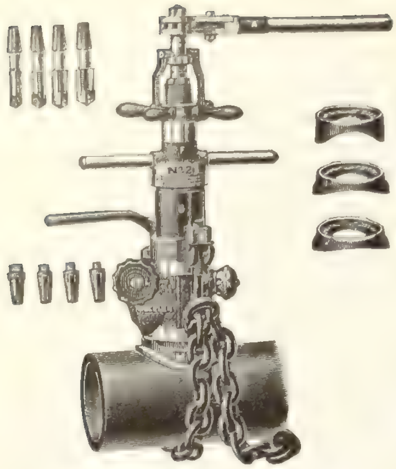

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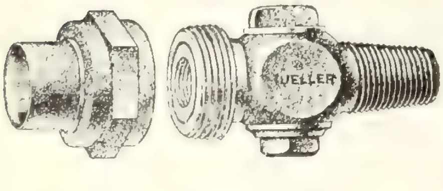

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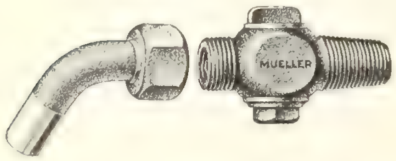

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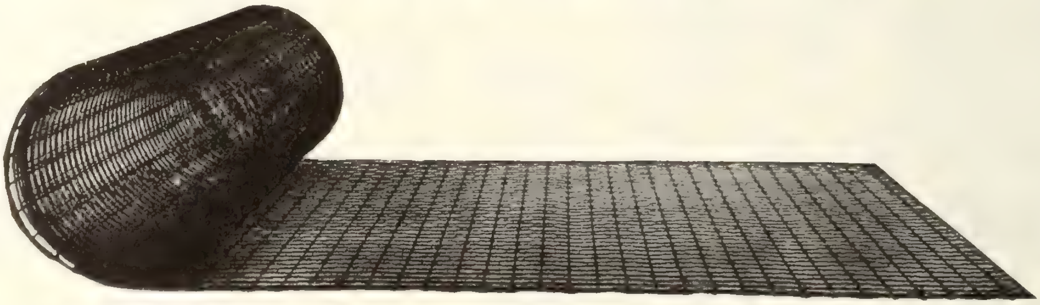

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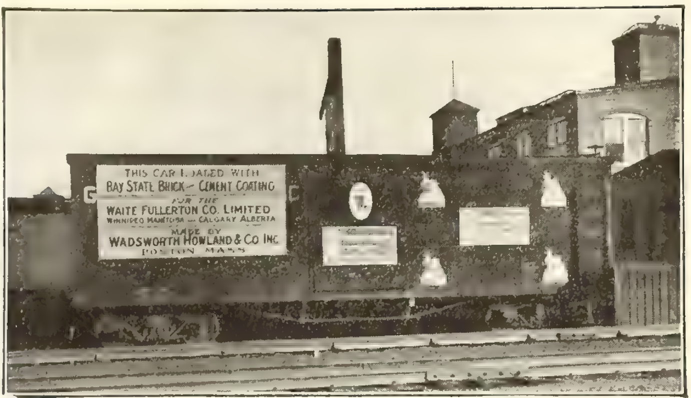
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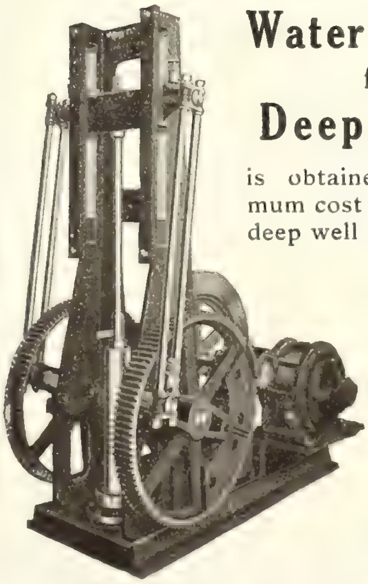

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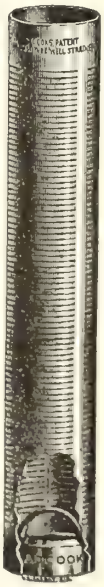

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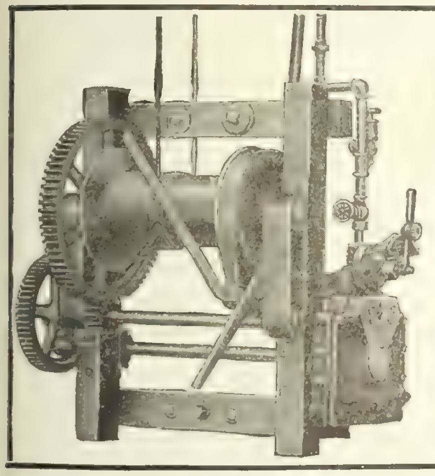

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The Ready Mixed
Hard Wall Plaster

Manufactured by

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Limited
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"Galvaduct" and "Loricated"

Conduits

for Interior Construction

Conduits Company, Limited
Sole Manufacturers under Canadian and U. S. Letters Patent
Toronto - Canada

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NATIONAL IRON WORKS, Limited

LARGEST MANUFACTURERS IN CANADA OF

CAST IRON PIPE

every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments — Offices, Works and Docks, TORONTO

THIS IS THE FOURTH OF A SERIES OF DISCUSSIONS OF SIX VITAL POINTS DETERMINING THE SELECTION OF AN

AIR COMPRESSOR

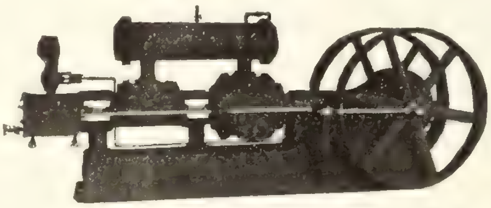
AN AIR COMPRESSOR THAT WILL RUN ITSELF IS AN IDEAL FOR THE SMALL PLANT

AUTOMATIC OPERATION

When a special man must be delegated to take charge of a small compressor in the small plant, his wages make a big addition to the cost of air.

With a Class "NE" or "NF" Compressor you need not figure on this expense. Start them in the morning—stop them at night—replenish their oil supply occasionally— this is all the attendance they need.

For they are thoroughly reliable, completely automatic self-regulating and in every way capable of taking care of themselves.



Class "NF-2" Convertible Steam or Belt Drive Compressor. Note position of steam cylinder; large intercooler, and rigid sub-base.

To begin with, they are so heavily built, so generously proportioned, so smooth running, so nicely balanced, that they are fully equal to steady, uninterrupted duty.

Their extreme simplicity reduces the "trouble possibility" — because freedom from "trouble" is in proportion to freedom from complication.

"Bath" lubrication solves the oiling problem—every bearing is literally flooded with oil by a positive system of distribution. The higher the speed, the more the oil delivered. And the oil is used repeatedly—economy of lubricant.

The regulation is perfect. Much or little air is automatically delivered, according to the demand. No attention is needed on this score.

What more can you ask, in the way of dependable automatic operation, from any machine?

There are four types of Class "N" Compressors—steam or power driven — compressing and delivering a surprising volume of air indefinitely.

You can get one at moderate cost ; set it up in a corner of your plant. Delegate one of your men to start it up, go about his regular work and shut it down at night. No extra labor cost here.

And you may know that your machine is making the most of the power you pay for.

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Sydney Montreal Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅛-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

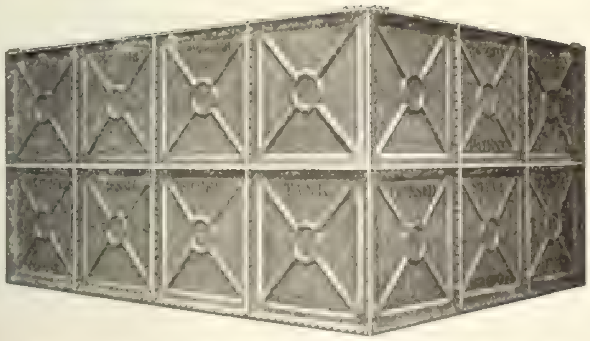
Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.



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Patent Pressed Steel Tanks

are built up of plates 4 ft. square by 5/16th in. thick. There are only three types of plates and all are interchangeable. Easily erected by unskilled labor.

LIGHT. STRONG. CHEAP. UNBREAKABLE.

IMMEDIATE DELIVERY FROM STOCK.

STEEL PIPES—Welded or Rivetted

of any diameter over 12 inches and having any desired type of joint.

Thomas Piggott & Co., Ltd.

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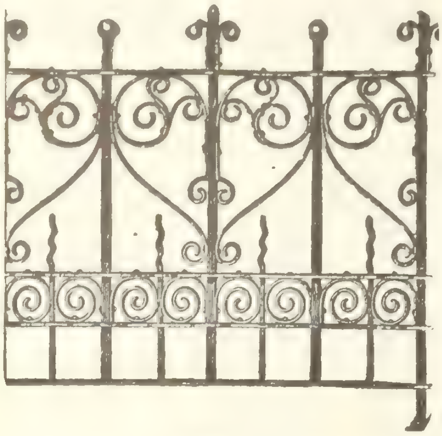

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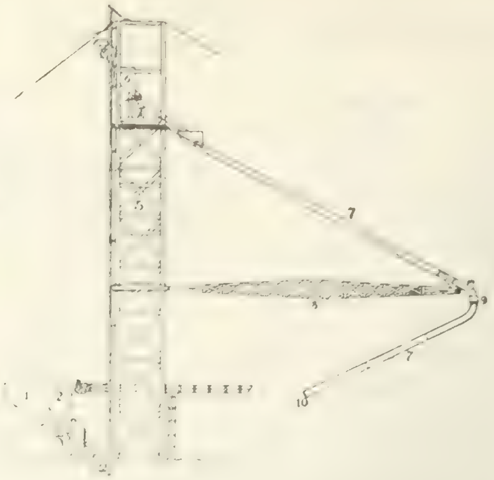

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When it comes to digging let your men do more efficient work by supplying them with "Lundy" or "Dandy" shovels.

They enjoy a national reputation for rigid construction and durability.

We will send to any contractor, free, express prepaid a sample shovel. Send for our illustrated catalogue showing our full line of Shovels, Spades, Scoops, Draining Tools, etc.

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Estimates furnished promptly. Capacity 18,000 Tons Annually.

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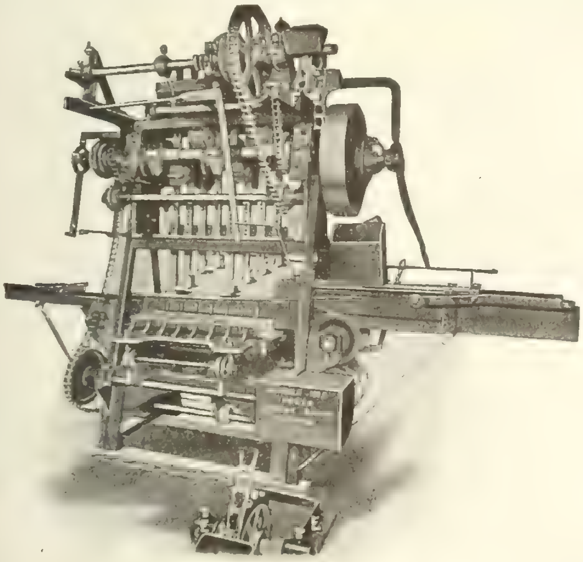
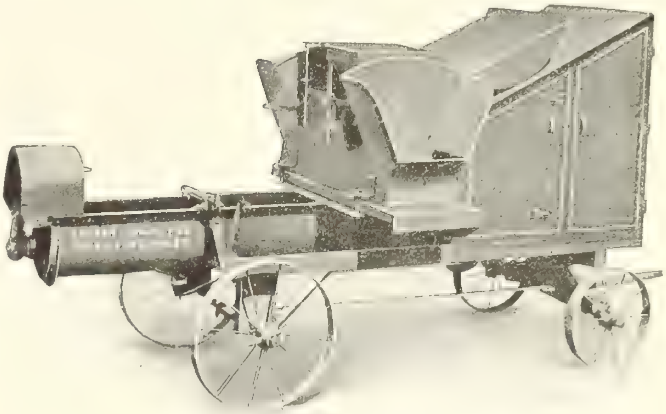


Besser Power Cement Brick Machine

Woodstock Wind-Motor Co., Ltd.
WOODSTOCK, ONTARIO



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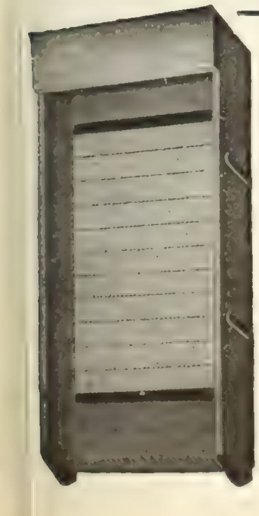

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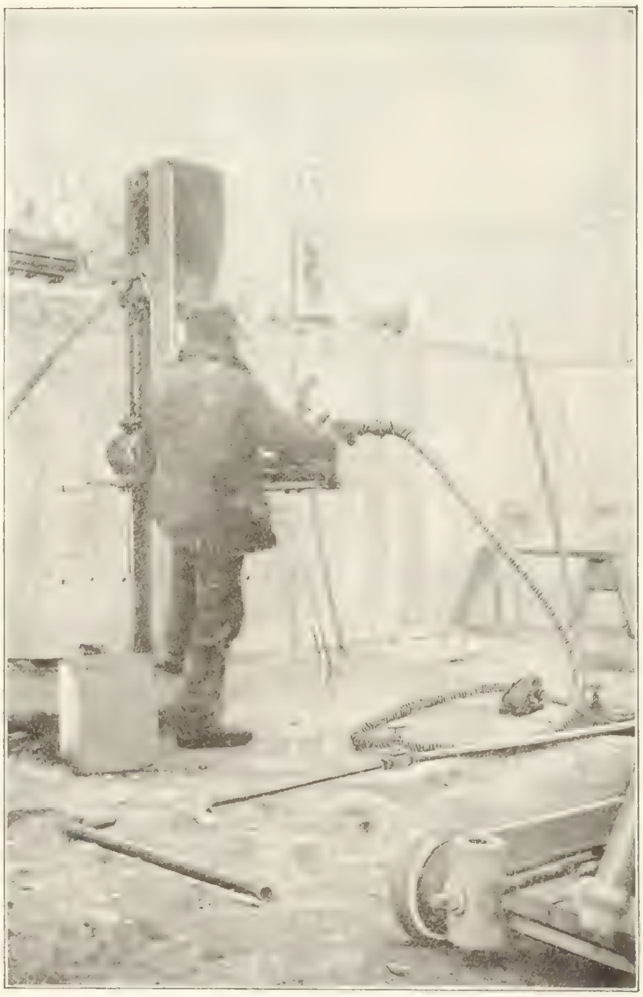

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Sprague Steel Armoured Hose consists of the best quality of rubber hose, closely covered with a metal armor composed of a single strip of highly Galvanized steel, wound spirally and inter-locking.

Sprague Flexible Steel Armoured Hose can be used advantageously wherever air or steam hose is now employed. Excavating and tunneling contractors, mining companies and quarrymen will find it far more efficient and economical in operating drills and other machinery than any hose heretofore used. Machinists using either air-driven or steam tools will find it much more durable and reliable than ordinary unarmoured or wire-wound hose.

A one-inch three-ply rubber hose, equipped with this armour, will stand a hydraulic test pressure of approximately 2,000 pounds.

The cost of frequent renewals and replacements of ordinary unarmoured rubber hose cannot be figured by the mere cost of replacing the material itself, as the discontinuance of service of steam drills and compressed air driven machines may be the fundamental source of tremendous expense.

Rough wearing places are met with in mines, tunnels and shafts, and Flexible Steel Armoured Hose meets these conditions precisely.

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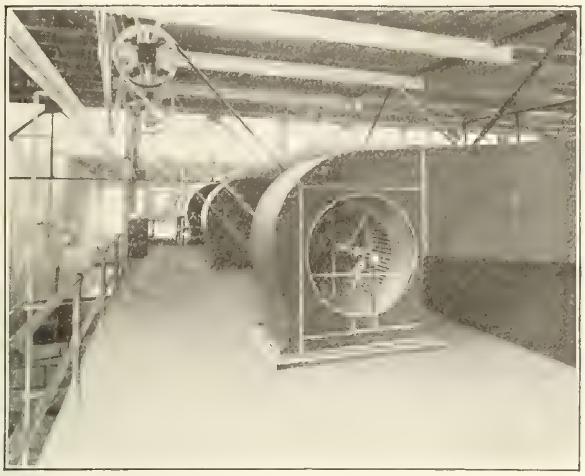

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8 of 29

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We design the entire system to meet your requirements.

We give service with the sale of our product---Real-Expensive-Hard-to-Get Service.

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whether you use it or not. If you buy a cheap wire, "made to meet a price," you may pay several times the cost of good wire in replacement of your wiring or of the building in which it is installed.

"Sterling" Rubber Insulated Wire

is made to maintain a standard, not to meet a price. The price, however, is as low as that for which a product of equal quality can be sold.
We have large, fresh stocks of rubber insulated wire, also weatherproof and bare wire, and can fill your orders promptly.

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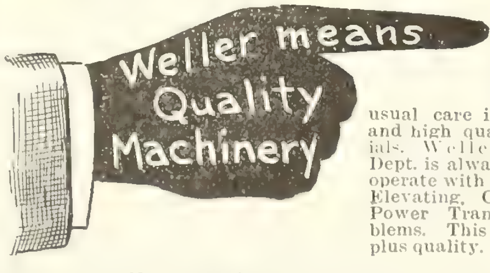

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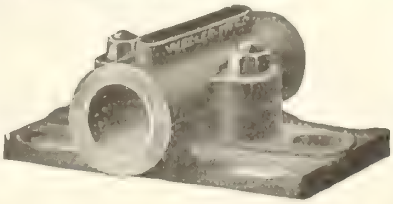

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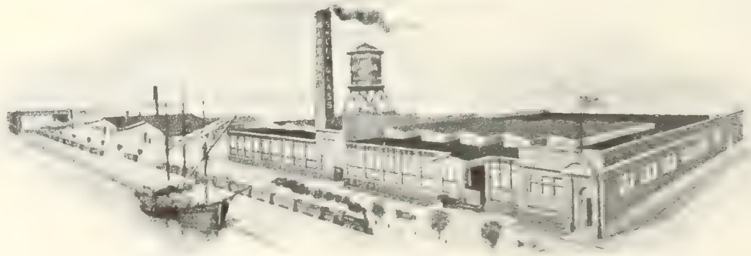

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which account for the superiority of

Creosoted Wood Block Pavements

Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

Its Ease of Repair; No difficulty being experienced in removing and replacing the blocks; no expensive plant or skilled workmen required.

Its Sanitary Qualities; Creosote being a highly antiseptic and waterproofing material instantly destroys all germs, prevents the absorption of street filth and consequent decay.

Its Noiselessness; The rattle and bang of vehicles passing over its smooth surface absorbed and muffled till the quiet of the dirt road is obtained.

Its Dustlessness; Does not pulverize; the heaviest traffic only pounding down the wood fibres to offer the greater resistance.

Its Cleanliness; Having a smooth surface and being waterproof it does not differ in this respect from asphalt.

We manufacture blocks of the highest possible standard, the very best materials only being used and in the Dominion Wood Blocks we believe we produce an article that has no equal.

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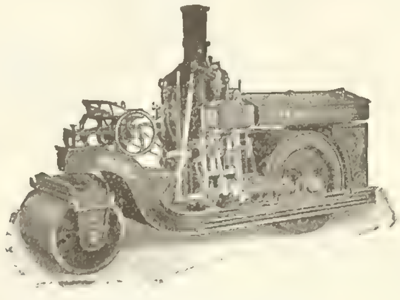

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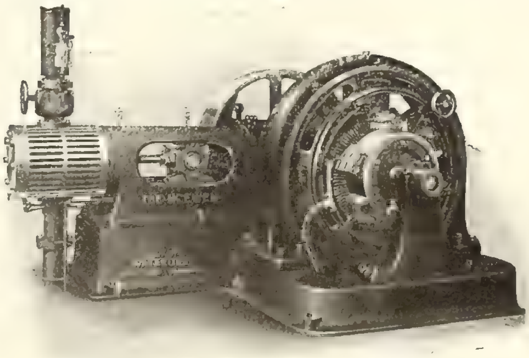

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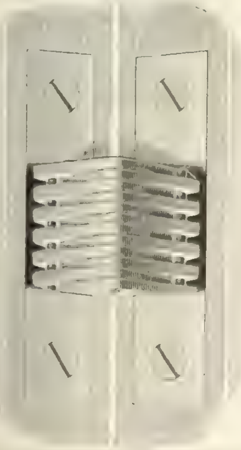

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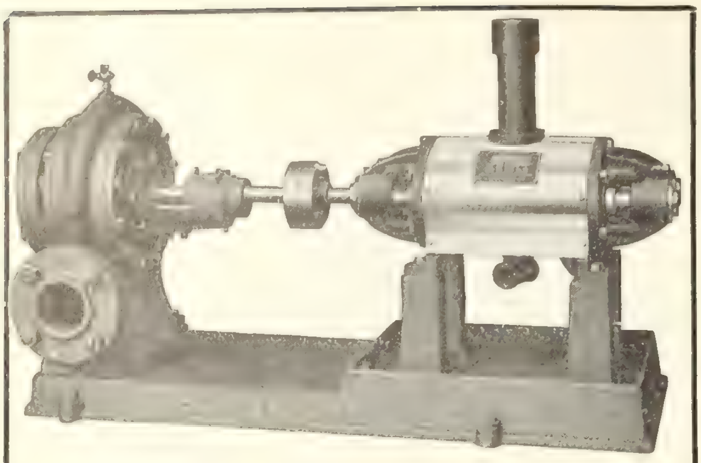

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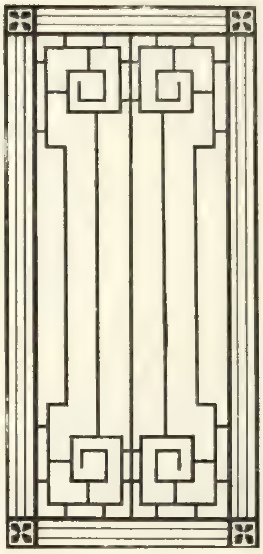

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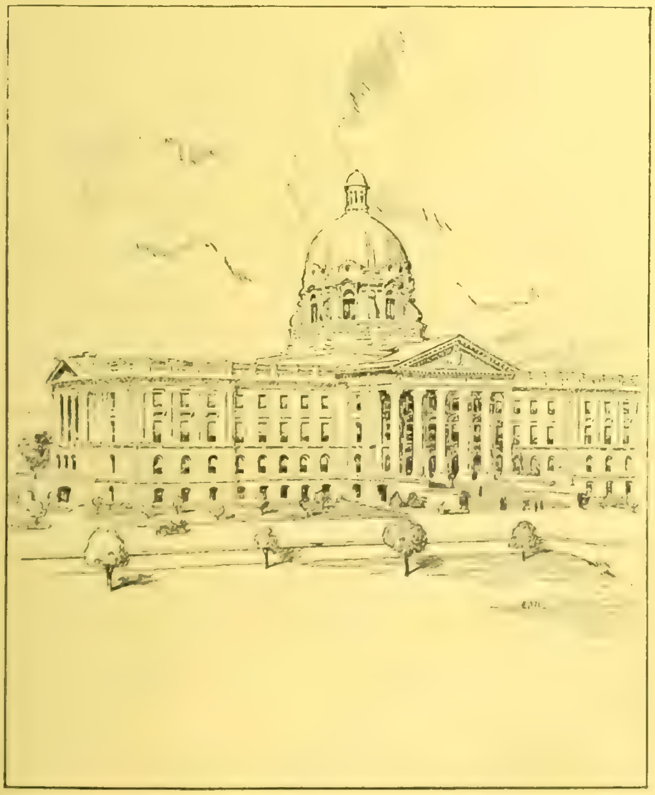

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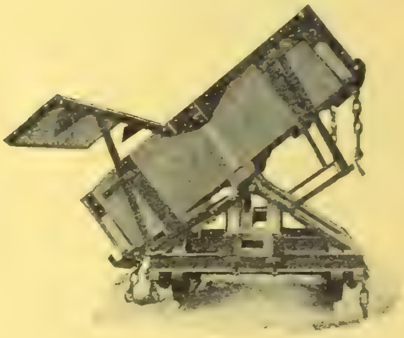

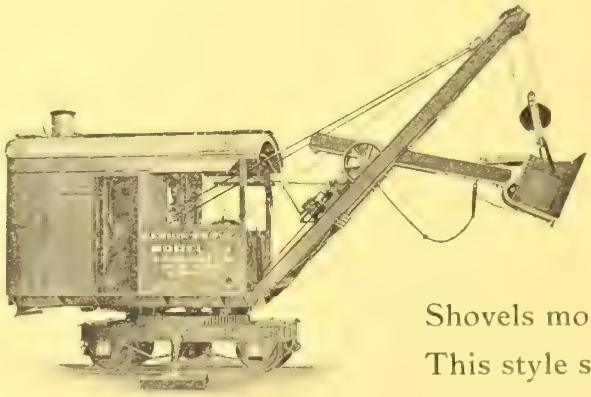

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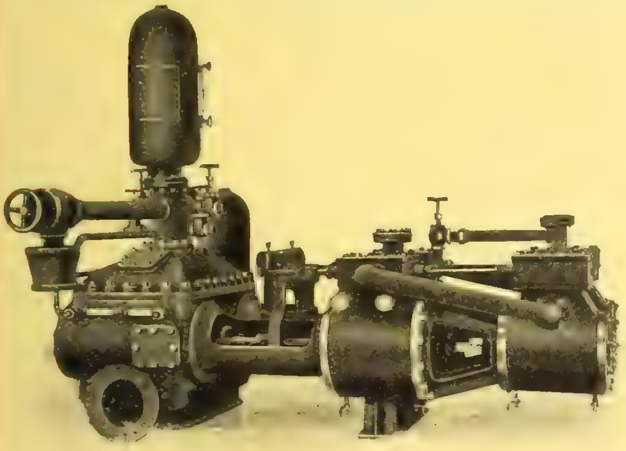

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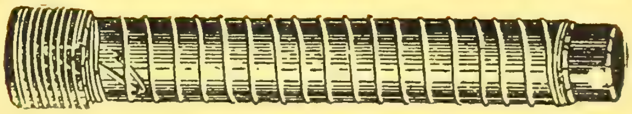

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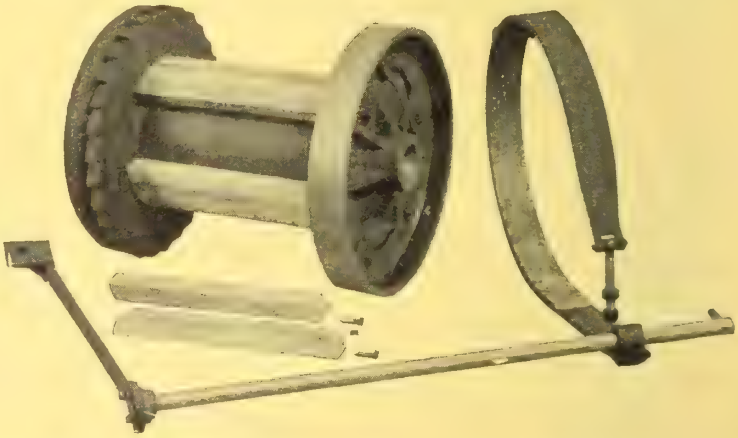

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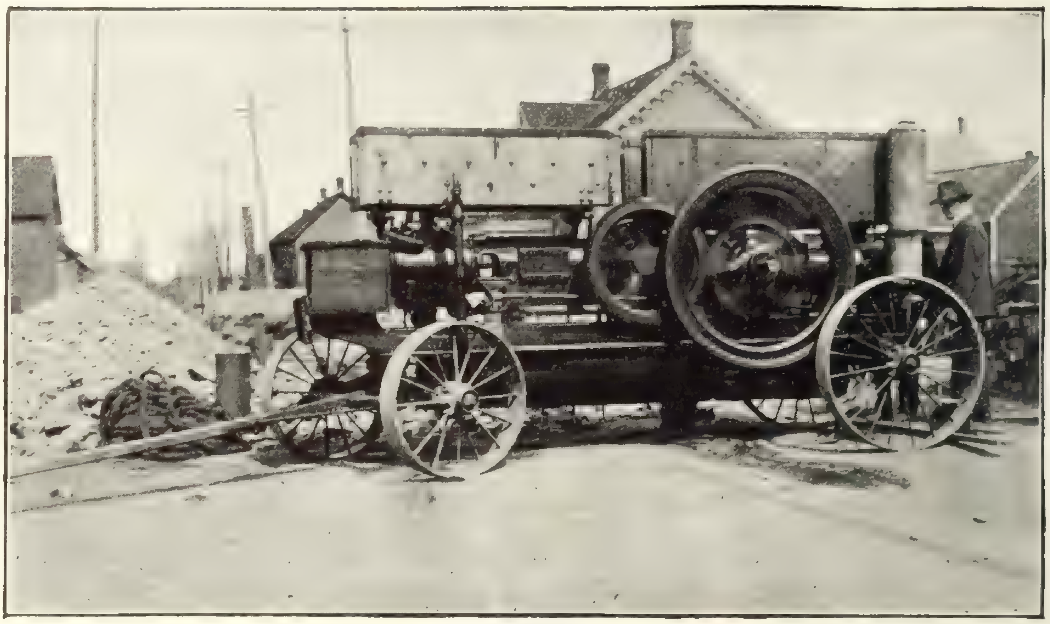

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Campbell, R.
Chipman & Power
Dominion Engineering & Inspection Company.
Farmer, John T.
Galt Engineering Co., John
Lea & Ferguson
Mitchell, C. H.
Thorold Co., F. W.

Expansion Bolts
Star Expansion Bolt Co.

Expanded Metal
Mannesmann Tube Co.

Exhaust Heads
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.

Fans
Canadian Sirocco Co.

Field Instruments
Gurley, W. & L. E.

Filters
American Water Softener Co.

Fire Brick
Improved Equipment Co.
Ontario Lime Co., Ltd.
Smyth & Ryan

Fire Escapes
McGregor & McIntyre

Fireproof Doors and Windows
Feather & Roadhouse
Metal Shingle & Siding Co.
Mussens Limited
Ormsby Co., Limited, A. B.
Steel & Radiation Limited

Fuse (Safety Blasting)
Lecky & Collis

Fixtures (Gas)
Consumers Gas Co.

Forges
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.

Forgings
Canadian Billings & Spencer, Ltd.

Furnaces (Special)
Improved Equipment Co.

Gasoline Engines
Wettlaufer Bros.

Gas Plants Complete
Improved Equipment Co.

Gas Producers for Heating
Improved Equipment Co.

Gas Machinery
Improved Equipment Co.

Glass
Consolidated Glass Co.
Hobbs Mfg. Co.
Luxfer Prism Co.
Toronto Plate Glass Imp't'g Co.

Gravel Washing Plants
Dull Co., Raymond W.

Hammer Drills
Canadian Ingersoll-Rand Co.

Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited

High Pressure Pipe Lines
Boving Company of Canada
Escher Wyss & Co.
Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Engineering Co.
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Jenckes Machine Co.
Hopkins & Co., F. H.
Lecky & Collis
Marsh & Henthorn
Mussens Limited
Royce Limited
Sturtevant Co. of Can. Ltd., B. F.

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Wettlaufer Bros.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

(Continued on page :)

The New
Royal Bank
Building,
Toronto,
To be
Fireproofed
Throughout
With
Don Valley
Porous
Terra Cotta
Fireproofing

The Largest Contract For Porous Terra Cotta Fireproofing

The largest contract ever placed for one building in the British Empire has been made for

Don Valley Porous Terra Cotta Fireproofing

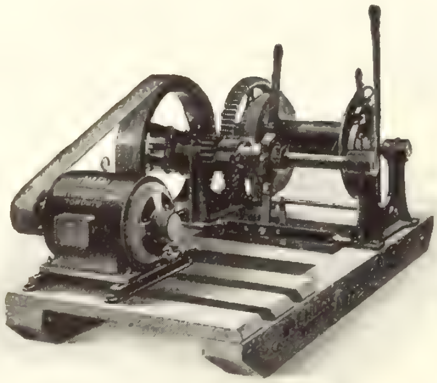
to be used in fireproofing the Royal Bank Building, Toronto.

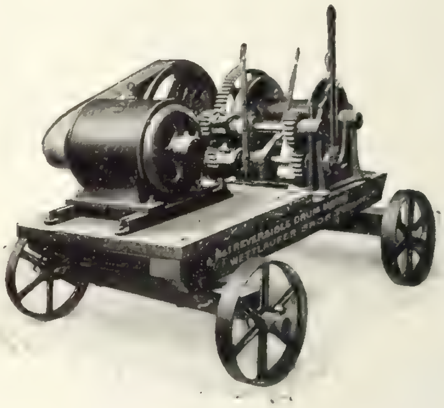
Don Valley Brick Works

Toronto, Ont.

Wettlaufer

Handy Hoists





The hoist illustrated is the Wettlaufer handy electric hoist, mounted on wheels or skid.

This is a particularly convenient hoist for contractors' use on light work.

Wettlaufer hoists are made in fourteen different types and sizes to suit every class of work ; power is supplied by electricity, steam or gasoline.

The Wettlaufer line also includes the famous heart shape drum mixer, made in many sizes and styles. Daily demonstrations are held at all our branches. If you are interested in the purchase of new equipment call at any branch and we will demonstrate our claim.

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask. ; Maysmith & Lowe, 1057 Mears St., Victoria, B C. ; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B. ; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C. ; J. L Lachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagauchetiere St. W., Montreal.

Rogers' Portland Cement

AND CRUSHED STONE

Concrete Arch Bridge of Embro, Ont., built with Rogers' Cement

C. E. URE, Woodstock, ENGINEER **BAIN & ROSS, Embro, CONTRACTORS**

Cost price $4,200. Length of span 75 ft. Total length of bridge, including wings, 120 ft. Ten tons twisted bars used in reinforcment.

Rogers' cement is the most dependable for all types of construction and engineering-contracting work—especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, etc.

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

CRUSHED STONE

Our crushed stone is free from dust, dirt and mold—it is really clean stone —properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

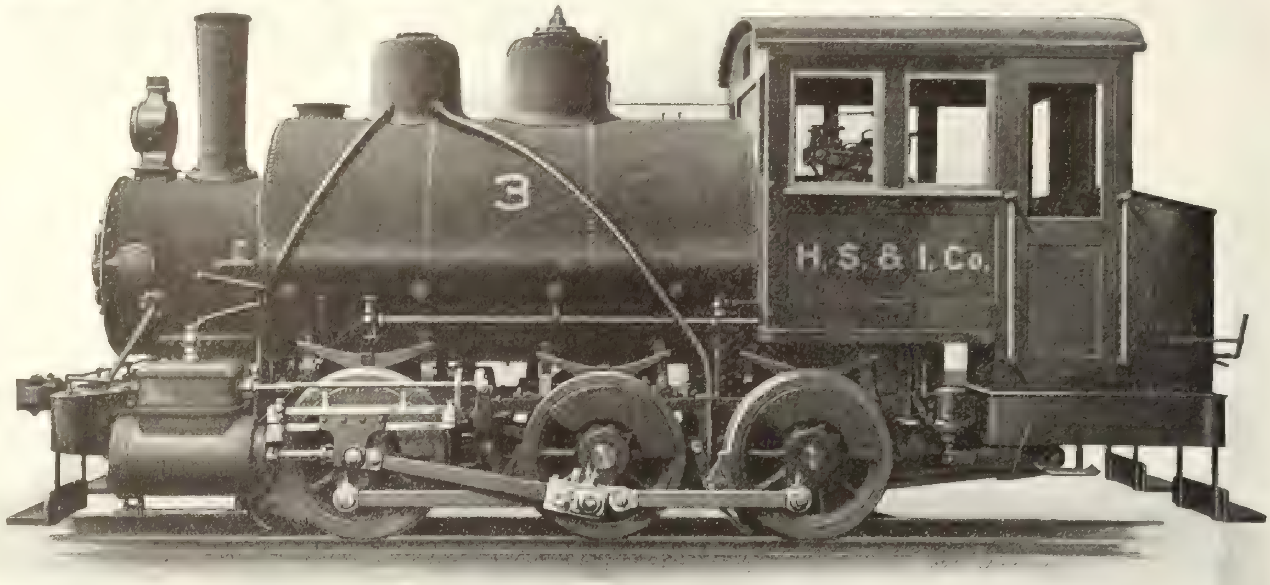
Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

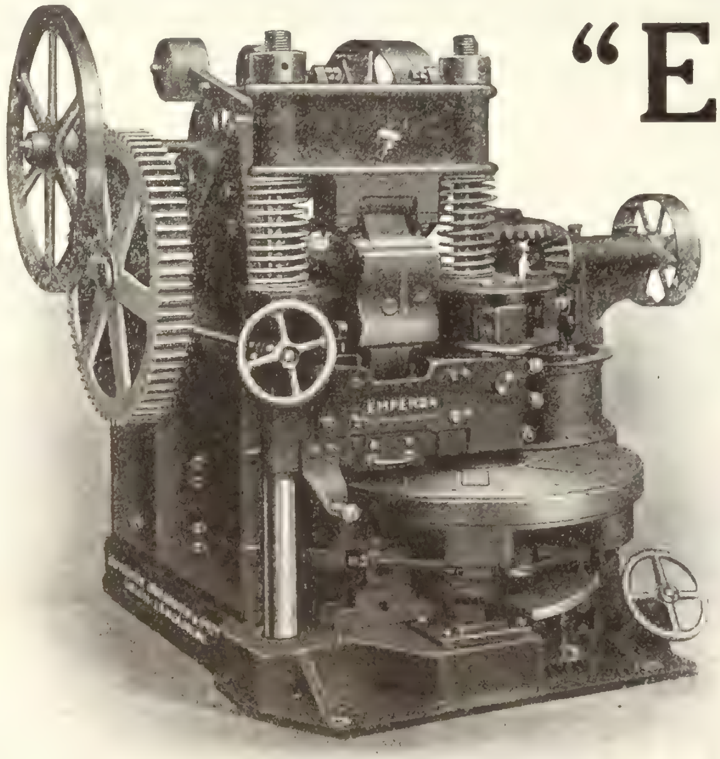
CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA



"Emperor"

Briquetting Press

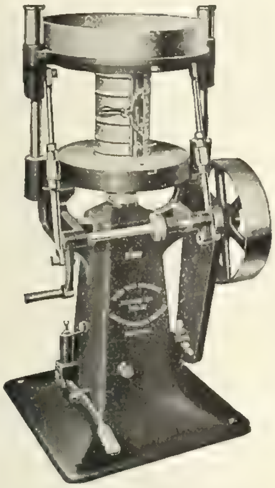
We can furnish complete brick plants on the most modern lines. Presses for sand-lime, clinker, clay and other bricks.

Write us for literature.

Sutcliffe, Speakman & Co., Limited
LEIGH, LANCASHIRE, ENG.

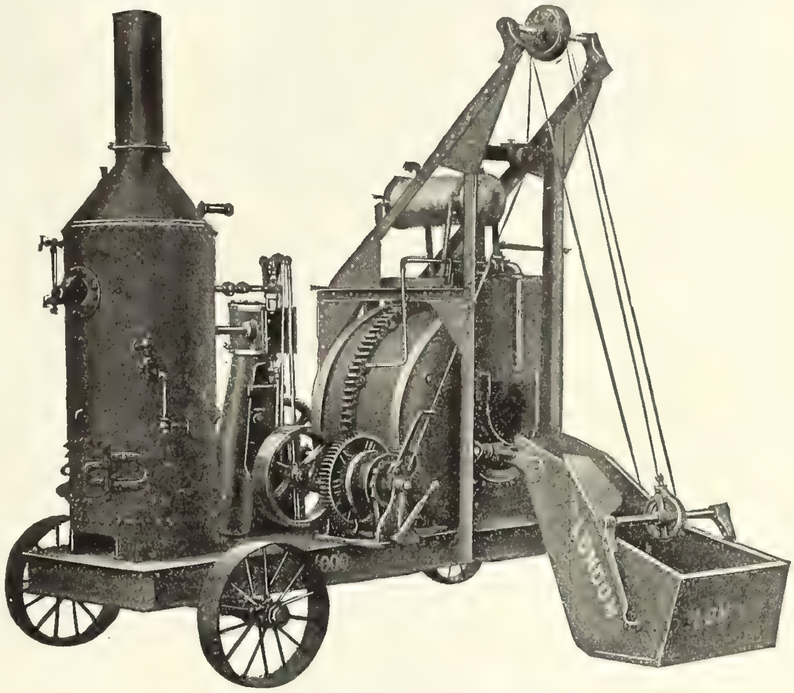
LONDON CONCRETE MACHINERY

Is Not Built Down to a Price, but Up to a Standard.



Dunn Cement Drain Tile Machine

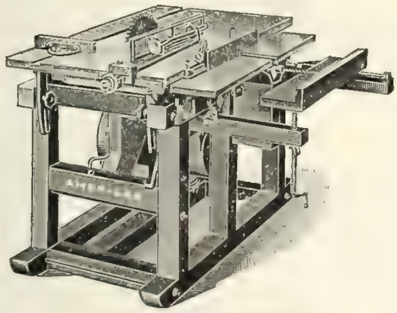
We Cannot Afford to Make anything but the Best.



London Standard Drum Batch Mixer

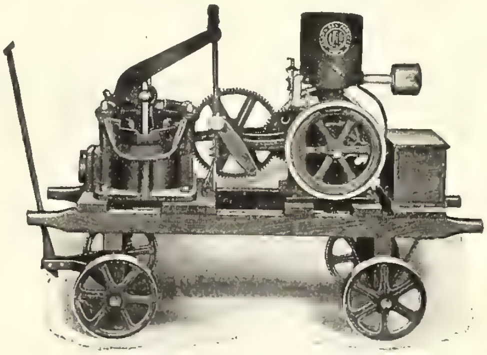
There are Large Profits in the manufacture of Cement Drain Tile.
Write for Particulars.

Over 600 London Concrete Mixers sold in Canada in Three Years.



Variety Woodworker

No Contractor can afford to be without a Variety Woodworker



Diaphram Pump with Power

We manufacture a complete line of Contractors' Machinery: Concrete Mixers, Hoisting Engines, All kinds of Pumps, Block Machines, Brick Machines, Tile Moulds, Derricks, Cars, Ornamental Moulds, Wheel Barrows, Carts, Scrapers and Cement Working Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:
WINNIPEG (445 Main St.) W. H. Rosevear, Mgr. CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (36 Alhambra Ave.) F. D. Emsley, Mgr.

AGENCIES:
VANCOUVER, B. C. Equipment Co. MOOSE JAW, Sask. Bridge & Iron Co., Ltd. REGINA, H. A. Knight
FORT WILLIAM, Northern Eng. & Supply Co. MONTREAL, Foss & Hill Mach. Co QUEBEC, A D. Masson

We are the Largest Manufacturers of Concrete Machinery in Canada.

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

- **Ice-making Machinery**
  - Linde British Refrigeration Co.
- **Insulating Compounds**
  - Standard Underground Cable Co. of Canada, Limited
- **Interior Finish and Doors**
  - Batts Limited
  - Canada Office & School Fur. Co.
  - Rhodes Curry & Co.
- **Kilns**
  - Canadian Buffalo Forge Co.
  - Sheldons Limited
  - Sturtevant Co. of Can. Ltd., B. F.
  - Canadian Sirocco Co.
  - Berg Machinery Mfg. Co.
- **Lighting and Pumping Installations**
  - Lister & Co., Ltd., R. A.
- **Lime**
  - Jamieson Lime Co.
  - Ontario Lime Co., Ltd.
- **Lime Kilns**
  - Improved Equipment Co.
- **Locomotives**
  - Buffalo Pitts Co.
  - Boving Company of Canada
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Locomotive Company
  - Montreal Locomotive Works
  - F. H. Hopkins Co.
  - Mussens Limited
- **Marble**
  - Missisquoi-Lautz Corporation
- **Metal Lath**
  - Greening Wire Co., B.
  - Metallic Roofing Co.
  - Noble, C. W.
  - Steel & Radiation Ltd.
- **Meters, Electrical**
  - Ferranti Electrical Mfg. Co.
  - Canadian Allis-Chalmers, Ltd.
- **Metal Forms**
  - Hotchkiss Lock Metal Form Co.
- **Meters, Water**
  - Hopkins & Co., F. H.
  - McDougall Caledonian Iron Wks.
  - Neptune Meter Co.
- **Paints (Bridge and Structural Iron and Pipe Coating)**
  - Dominion Paint Works
  - Goheen Mfg. Co.
  - Ottawa Paint Co.
- **Paints and Varnishes**
  - Dominion Paint Works
  - Goheen Mfg. Co.
- **Paving and Paving Materials**
  - Asphalt & Supply Co.
  - Barber Asphalt Paving Co.
  - Dominion Creosoting Company
  - Ontario Asphalt Block Co.
  - Paterson Mfg. Co., B.
- **Perforated Metals**
  - Canada Wire & Iron Goods Co.
  - Greening Wire Co., B.
- **Pipe (Concrete, Iron and Wood)**
  - American Spiral Pipe Works
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Pipe Co.
  - Dominion Concrete Co.
  - Dominion Wood Pipe Co.
  - Gartshore-Thomson Pipe Co.
  - Munderloh & Co.
  - National Iron Works
  - National Pipe & Foundry Co.
  - Pacific Coast Pipe Co.
  - Piggott & Co., Thos.
  - Walsh Plate & Structural Works.
- **Pile Driving Machinery**
  - American Hoist & Derrick Co.
  - Browning Engineering Co.
  - Canadian Ingersoll-Rand Co.
  - Lecky & Collis
- **Pipe Fittings and Flanges**
  - Pittsburgh Valve, Foundry & Construction Company
- **Planing Mill Exhausters**
  - Canadian Buffalo Forge Co.
  - Sheldons Limited
  - Canadian Sirocco Co.
- **Plug Drillers**
  - Canadian Ingersoll-Rand Co.
- **Plaster**
  - Alabastine Hardmortar Co.
  - Albert Mfg. Company
  - Britnell & Company
  - Ontario Lime Co., Ltd.
- **Plumbing Supplies**
  - Mueller Mfg. Co., H. .
- **Plumbing**
  - Dietrich Limited
- **Pneumatic Machinery**
  - Canadian Ingersoll-Rand Co.
- **Portable Saws**
  - Canadian Fairbanks-Morse Co.
- **Portable Track**
  - Bechtels Limited
- **Power Engines**
  - Inglis Company, John
  - Jenckes Machine Company
  - Canadian Allis-Chalmers, Ltd.
  - Waterous Engine Works
- **Pumps and Pumping Machinery**
  - Beatty & Sons, M.
  - Boving Company of Canada
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Buffalo Forge Co.
  - Canadian Fairbanks-Morse Co.
  - Canadian Ingersoll-Rand Co.
  - Canadian Sirocco Co.
  - Cook, A. D.
  - Hamilton Mfg. Co., Wm.
  - Inglis & Company, John
  - McDougall Caledonian Iron Wks.
  - Smart-Turner Machine Co.
  - Waterous Engine Works Co.
  - Mussens Limited
  - Ontario Wind Eng. & Pump Co.
  - Wettlaufer Bros.
- **Quarry Machinery**
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Ingersoll-Rand Co.
  - Improved Equipment Co.
  - Lecky & Collis
  - George Anderson & Co.
- **Radial Brick Chimneys**
  - H. R. Heinicke Inc
- **Railway Supplies**
  - Gartshore, John J.
  - Hopkins & Co., F. H.
  - Lecky & Collis
  - Mussens Limited
- **Refrigeration Machinery**
  - Linde British Refrigeration Co.
- **Revolving Stone Screens**
  - Greening Wire Co., B.
- **Reinforcements, Concrete & Steel**
  - Canada Steel Co., Ltd.
  - Canada Wire & Iron Goods Co.
  - Greening Wire Co., B.
  - Steel Company of Canada
  - Steel & Radiation Ltd.
  - Trussed Concrete Steel Co.
- **Road Asphalt**
  - Barber Asphalt Paving Co.
  - Asphalt & Supply Co.
- **Road Machinery**
  - Dore & Fils
  - Erie Machine Shops
  - Lecky & Collis
  - Morrison & Co., T. A.
  - Mussens Limited
  - Waterous Engine Works Co.
  - Western Wheeled Scraper Co.
- **Roofing Material**
  - Asbestos Mfg. Company
  - Barber Asphalt Paving Co.
  - Bird & Sons, F. W.
  - Can. H. W. Johns-Manville Co.
  - Metallic Roofing Company
  - Noble, Clarence W.
  - Paterson Mfg. Co.

(Continued on page 14)

Ferranti Meters

THE smallest amount of current on the heaviest load is accurately measured on a Ferranti meter. Our meters are guaranteed for three years against all mechanical or electrical defects.

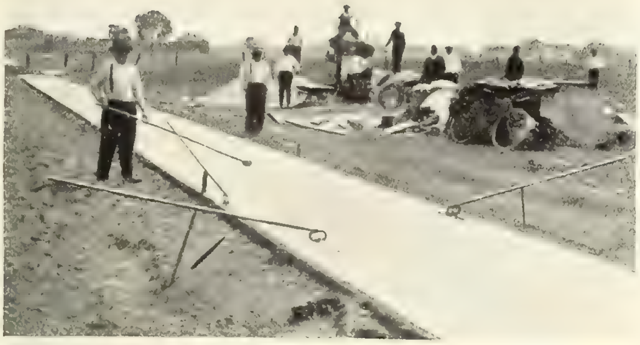
Ferranti meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

Illustration shows our improved type "C" meter, single or polyphase; top or bottom connections; clock or cyclometer dials.

A postal card will bring complete particulars on Ferranti meters.

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO
Farmers' Advocate Building, Cor. Notre Dame & Langside, WINNIPEG



Our Special Discount Offer

is proving quite attractive, and our shipping department is somewhat exercised as a result of our last week's advertisement in the Record.

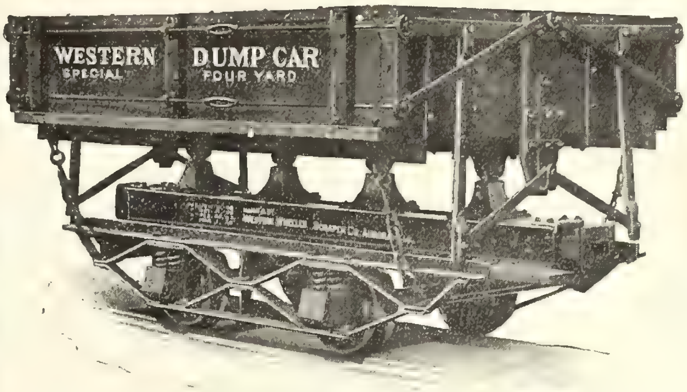
REMEMBER this 20 per cent. discount offer holds good only during the present month of December, 1913, and your order must reach us not later than midnight, December 31st, with cash enclosed. No shipments made otherwise.

See our full page ad. in the December 10th issue of the Contract Record and send in your order accordingly as no deviation whatever can be made from the terms of this offer.

Our binding guarantee as published gives you every assurance of satisfaction, but those who know the "ABRAM" line of Tools, need NO guarantee.

Large New Catalogue FREE. Write for it today.

ABRAM CEMENT TOOL COMPANY
Windsor, Ont.



It is a well known adage that necessity is the mother of invention. The immense earth moving enterprises undertaken and accomplished in the past few years have necessitated the perfection of a dump car fo handling material quickly and economically.
The satisfactory dump car which meets every requirement—the dump car of the

Past, Present and Future
is the
WESTERN DUMP CAR
Write for Catalogue.

WESTERN WHEELED SCRAPER CO.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta.
Can. Equipment Co., Montreal—Agents for Eastern Canada.

Macadam Roads

must be built of a
Tough Stone
that will cement

WE HAVE IT

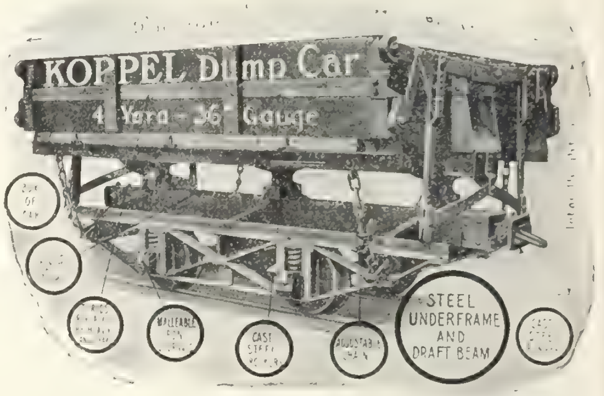
The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

- **Rubber Belting**
  - Goodyear Tire & Rubber Co.
  - Canadian Fairbanks-Morse Co.
- **Safes and Vaults**
  - Taylor, J. & J.
- **Sand and Gravel**
  - Ontario Lime Co., Ltd.
  - Sand and Supplies Limited
  - York Sand and Gravel Co.
  - Alfred Rogers Limited
- **Screens**
  - Canada Wire & Iron Goods Co.
  - Greening Wire Mfg. Co., B.
  - Weller Mfg. Co.
- **Sewer Pipe**
  - Britnell & Company
  - Canada Iron Corporation
  - Dominion Sewer Pipe Co.
  - Gartshore Thomson Pipe Co.
  - National Iron Works
  - Nova Scotia Clay Works Ltd.
  - Ontario Lime Co., Ltd.
  - Ontario Sewer Pipe Co.
  - Smyth & Ryan
  - Standard Clay Products Ltd.
- **Sewer Trenching**
  - Lecky & Collis
- **Sound Deadening**
  - Cabot, Inc., Samuel
- **Shovels (Steam)**
  - Browning Engineering Co.
  - Beatty & Sons, M.
  - Canadian Allis-Chalmers, Ltd.
  - Hopkins & Co., F. H.
  - Montreal Locomotive Works
  - Mussens Limited
  - Thew Automatic Shovel Co.
- **Smoke Stacks**
  - Chicago Bridge & Iron Works
  - Des Moines Bridge Co.
  - Hamilton Mfg. Co., Wm.
  - Walsh Plate & Structural Works
- **Shovels**
  - Lundy Shovel & Tool Co.
- **Stains, Shingle, Cement & Brick**
  - Cabot, Inc., Samuel
- **Stair Builders**
  - McGregor & McIntyre
- **Steam Apparatus and Specialties**
  - Canadian Buffalo Forge Co.
  - Pittsburgh Valve, Foundry and Construction Company
  - Sheldons Limited
  - Sturtevant Co. of Can. Ltd. B. F.
- **Steel Tubes**
  - Mannesmann Tube Co.
- **Steam Turbines**
  - Canadian Allis-Chalmers, Ltd.
  - McDougall Caledonian Iron Wks.
- **Steel**
  - Canada Steel Co., Ltd.
  - Can. Billings & Spencer
  - Lecky & Collis
- **Steel Bars**
  - Canada Steel Co., Ltd.
  - Steel Co. of Canada
  - Steel & Radiation, Ltd.
- **Steel Pipe**
  - Gerald Lomer, Limited
- **Stone**
  - Britnell & Company
  - Brodie, James
  - Consolidated Stone Company
  - Contractors' Supply Company
  - Crushed Stone, Limited
  - Hagersville Contracting Co.
  - Mahan & Company
  - McMillan & Son, W.
  - Morrison & Co., T. A.
  - Myers, Oakley
  - Ontario Lime Co., Ltd.
  - Queenstown Quarry Co.
  - Rogers Supply Company
  - Sackville Freestone Company
  - Sand & Supplies
  - Smyth & Ryan
- **Stone Saws**
  - Anderson, Geo.
- **Store Fronts**
  - Zouri Drawn Metals Co.
- **Structural Iron and Steel**
  - Canadian Allis-Chalmers, Ltd.
  - Canada Steel Company
  - Chicago Bridge & Iron Works
  - DesMoines Bridge Company
  - Dominion Bridge Company
  - Hamilton Bridge Works Co.
  - Mackinnon Holmes & Co.
  - Manitoba Bridge & Iron Works
  - Maritime Bridge Company
  - McGregor & McIntyre
  - Phoenix Bridge & Iron Works
  - Reid & Brown
  - Sarnia Bridge Company
  - Steel Company of Canada
  - Structural Steel Company
  - Standard Steel Construction Co.
  - Walsh Plate & Structural Works
- **Submarine Drills**
  - Lecky & Collis
- **Swinging Gears**
  - Dake Engine Company
- **Tanks and Stand Pipes**
  - Chicago Bridge & Iron Works
  - DesMoines Bridge Company
  - Hamilton Mfg. Co., Wm.
  - Inglis, John
  - Jenckes Machine Co.
  - Marsh & Henthorn
  - McDougall Caledonian Iron Wks.
  - Ontario Wind Eng. & Pump Co.
  - Piggott & Co., Thos.
  - Walsh Plate and Structural Wks.
  - Waterous Engine Works Co.
- **Testing and Inspecting Bureau**
  - Hunt & Co., Robt. W.
- **Turnbuckles**
  - Canadian Billings & Spencer, Ltd.
- **Underground Conduit**
  - Dietrich Limited
- **Ventilating & Heating Apparatus**
  - Canadian Buffalo Forge Co.
  - Canadian Sirocco Company
  - Sheldons Limited
  - Sturtevant Co. of Can. Ltd. B. F.
- **Vacuum Cleaners**
  - Tuec Company
  - Canadian Allis-Chalmers, Ltd.
  - Canada Iron Corporation
  - Gartshore-Thomson Pipe Co.
  - Kerr Engine Company
  - Pittsburgh Valve, Foundry & Construction Company
- **Varnishes—Insulating**
  - Standard Underground Cable Co. of Canada, Ltd.
- **Wall Board**
  - Bird & Son, F. W.
- **Waterproofing**
  - Cabot Inc., Samuel
  - Can. H. W. Johns-Manville Co.
  - Wadsworth Howland Co.
- **Water Softeners and Filters**
  - American Water Softener Co.
- **Water Tapping Machine**
  - Mueller Mfg. Co., H.
- **Water Turbines**
  - Canadian Allis-Chalmers, Ltd.
  - Boving Company of Canada
  - Escher Wyss & Co.
  - Hamilton Mfg. Co., Wm.
  - McDougall Caledonian Iron Wks.
- **Wires and Cables**
  - Canada Wire & Cable Co.
  - Imperial Wire & Cable Co.
  - Standard Underground Cable Co. of Canada, Limited
- **Wire Guards and Screens**
  - Canada Wire & Iron Goods Co.
  - Greening Wire Co., B.
  - Steel Company of Canada
- **Wire Rope**
  - Canada Wire & Cable Co.
  - Greening Wire Co., B.
  - Steel Company of Canada
- **Wrenches**
  - Canadian Billings & Spencer, Ltd.
- **Wrenches**
  - Can. Billings & Spencer, Ltd.

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Tarvia

Preserves Roads
Prevents Dust~

Brant Road, Galt, Ont., Canada. Constructed with Tarvia Modern Pavement.

Of Interest To Taxpayers

A cloud of dust behind an automobile means that the road surface is being destroyed—blown away. It also means that the road is unfit for modern traffic—that it has been built in the old way intended for slow-moving, horse-drawn traffic.

The science of MacAdam has been rewritten these last few years. A mineral binder is no longer enough to hold the stone together.

Something stronger is needed, and the use of Tarvia is the logical and necessary answer to a difficult problem.

In the tarviated road, there is a matrix of Tarvia around each stone, holding it firmly to its work and preventing it from shifting. There is no internal movement and the attrition of traffic is reduced to a minimum.

If the road is built with Tarvia the extra cost of the treatment is more than made up in longer life and reduced maintenance costs.

Tarxia is made in three grades—"Tarvia X" is a dense, viscid coal tar product of great bonding power, suitable for building macadam roads; "Tarvia A" and "Tarvia B" are thinner grades suitable for roads already in use, to preserve them and make them dustless.

Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.

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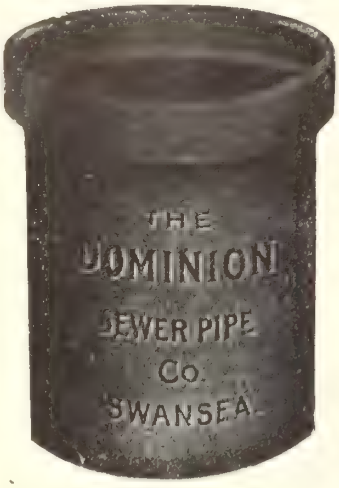

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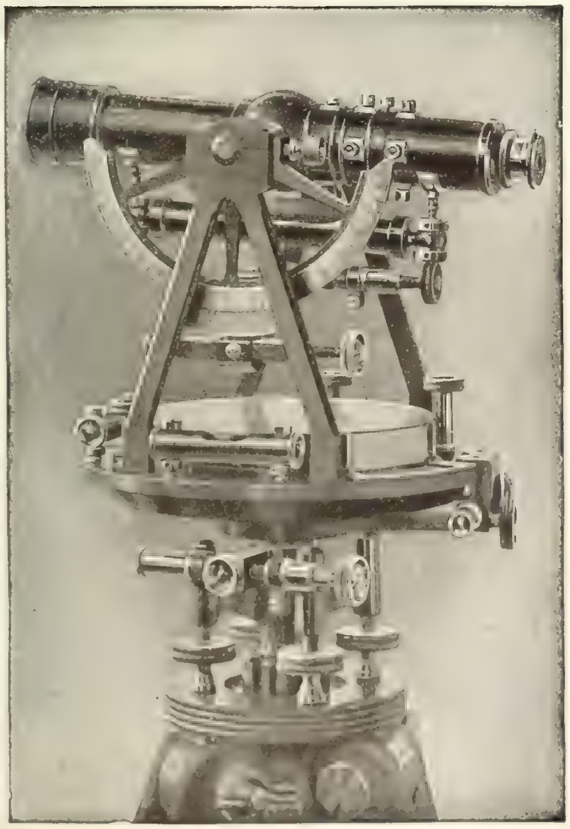

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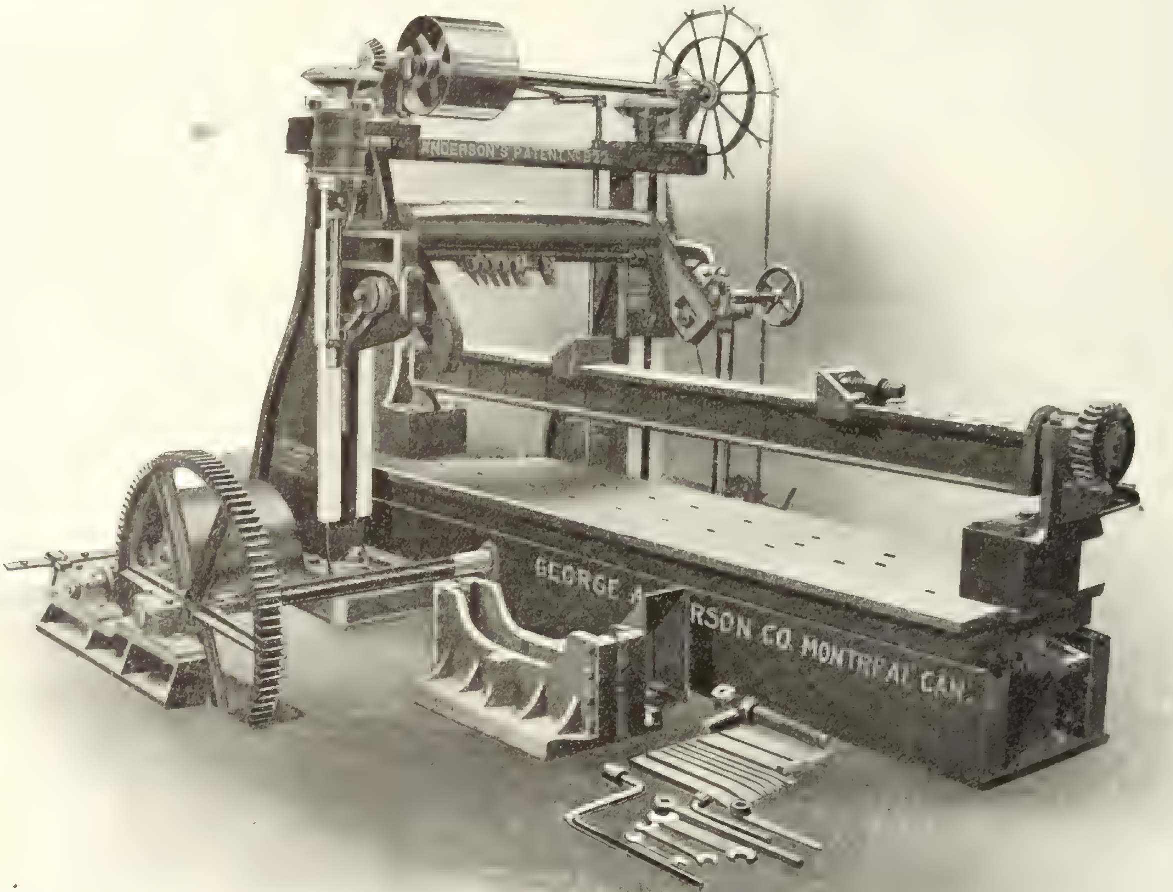
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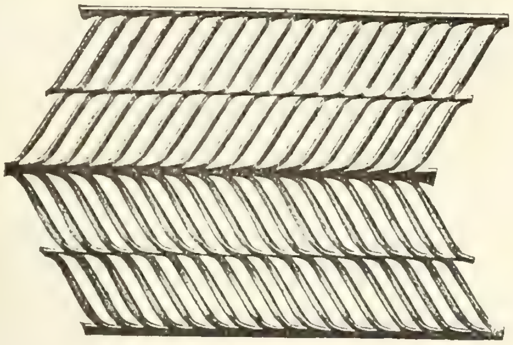

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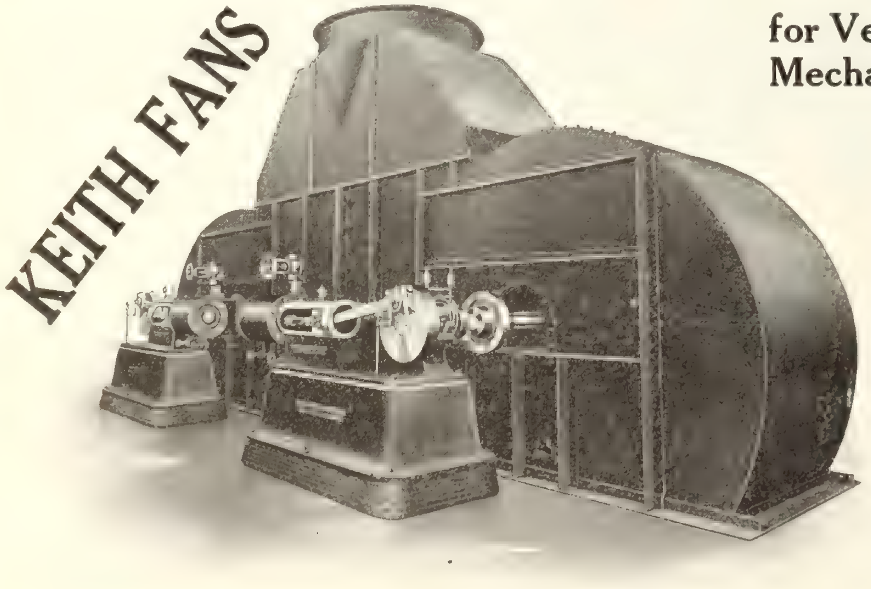

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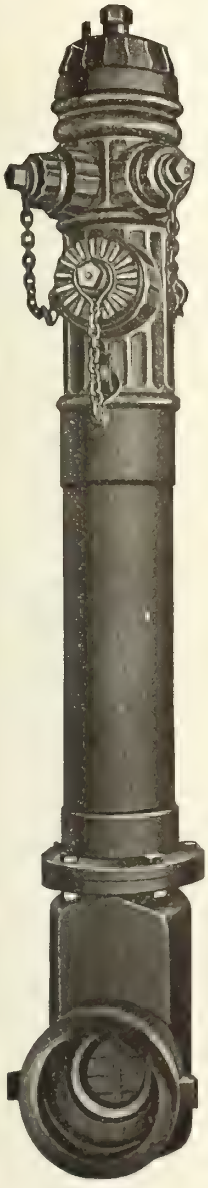

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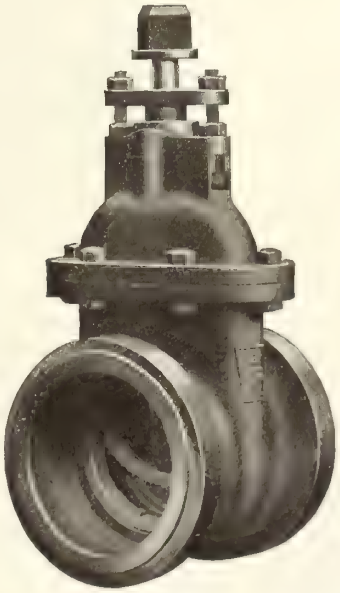

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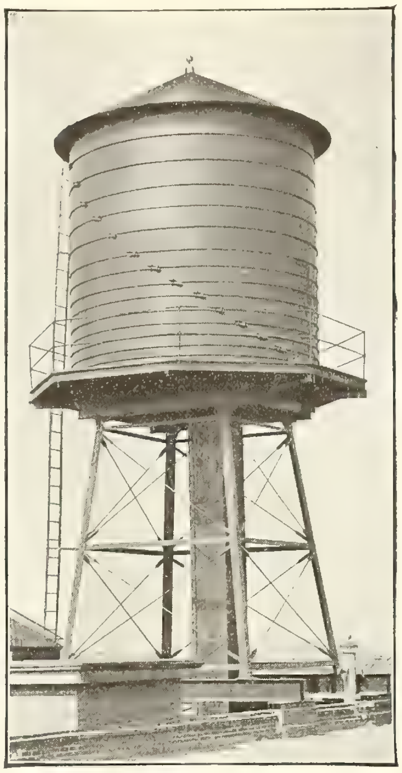

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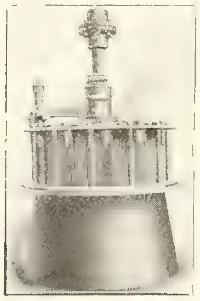

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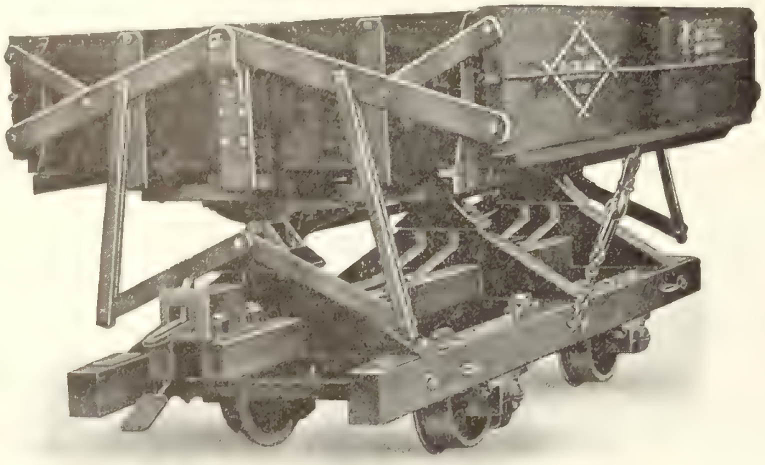

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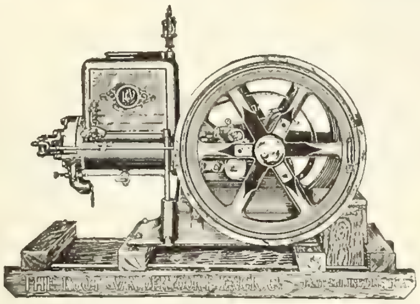

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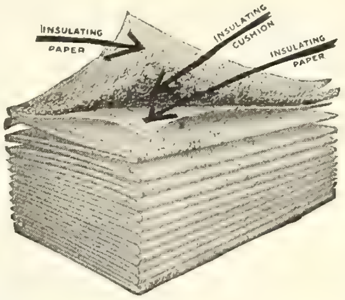

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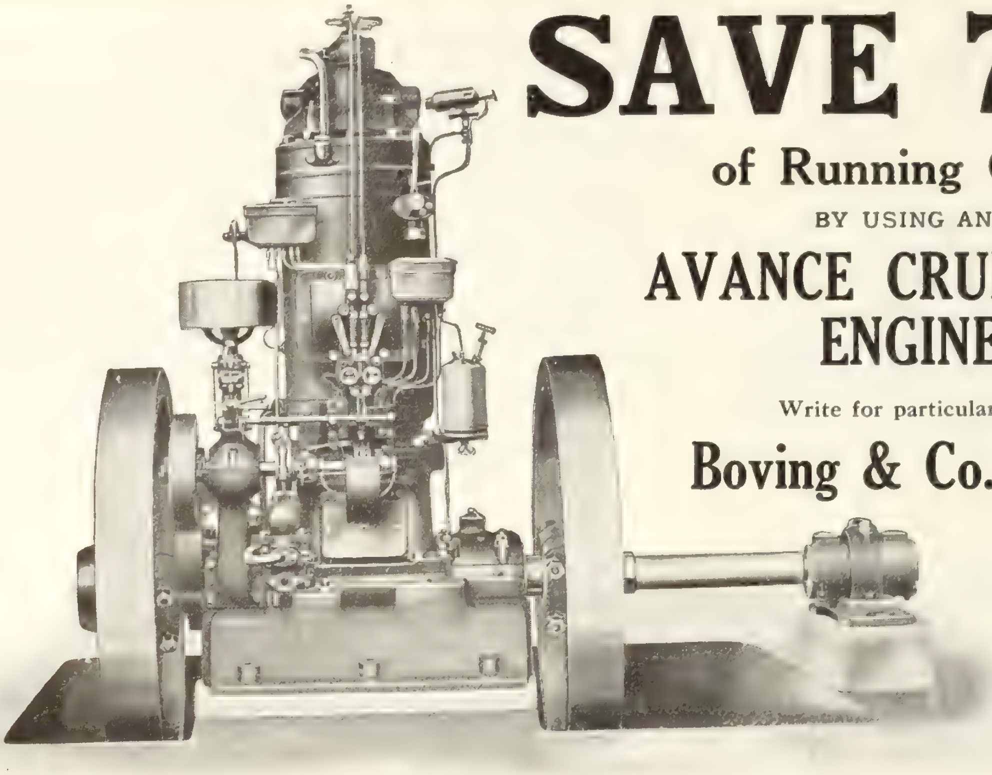

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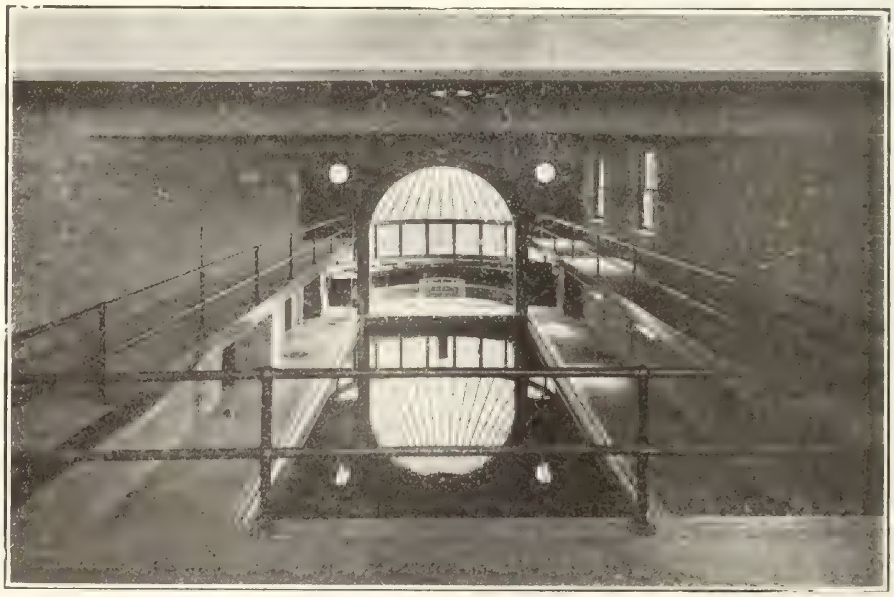

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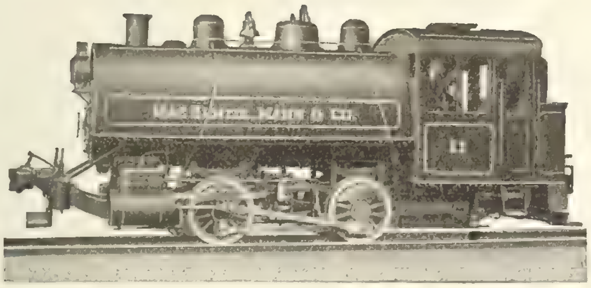

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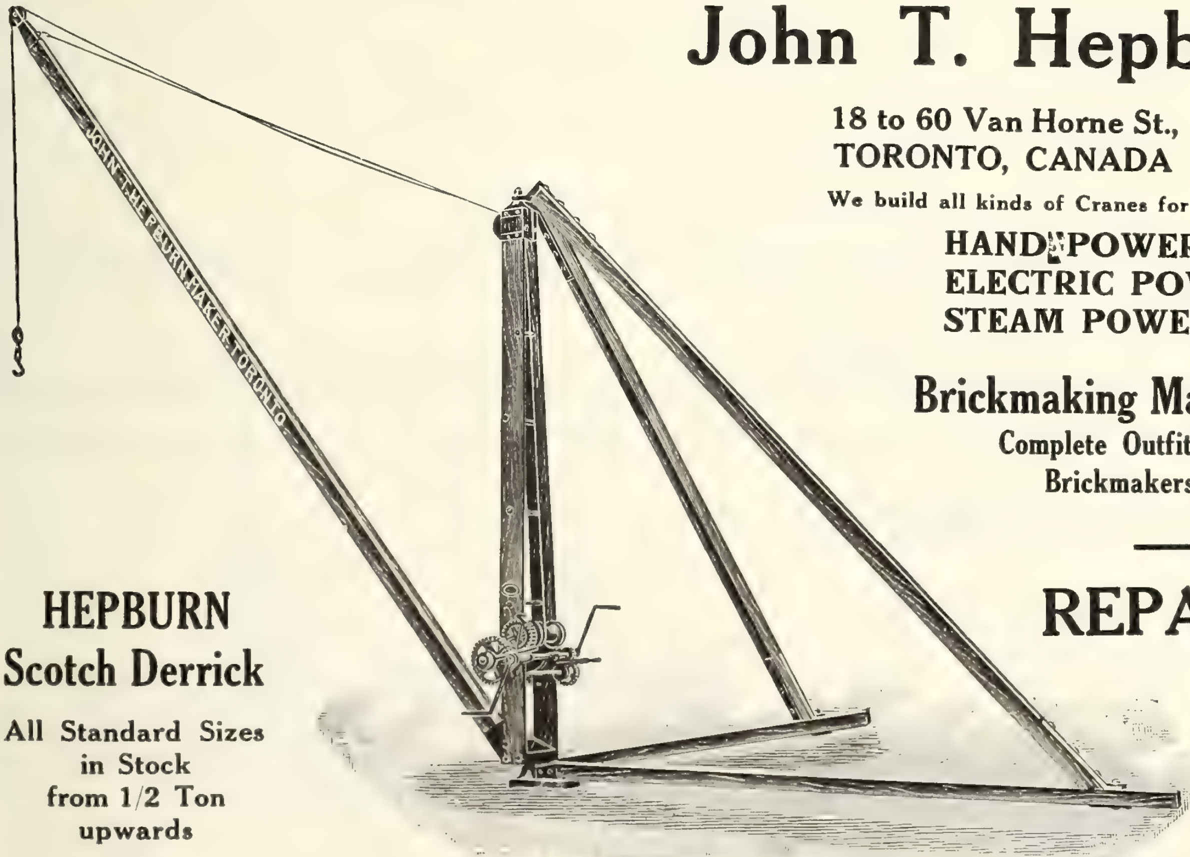
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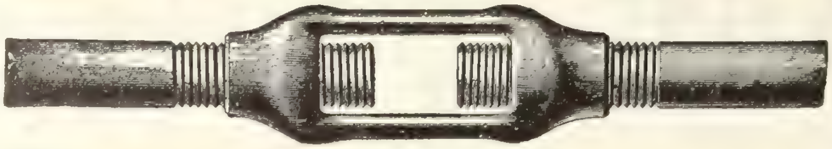

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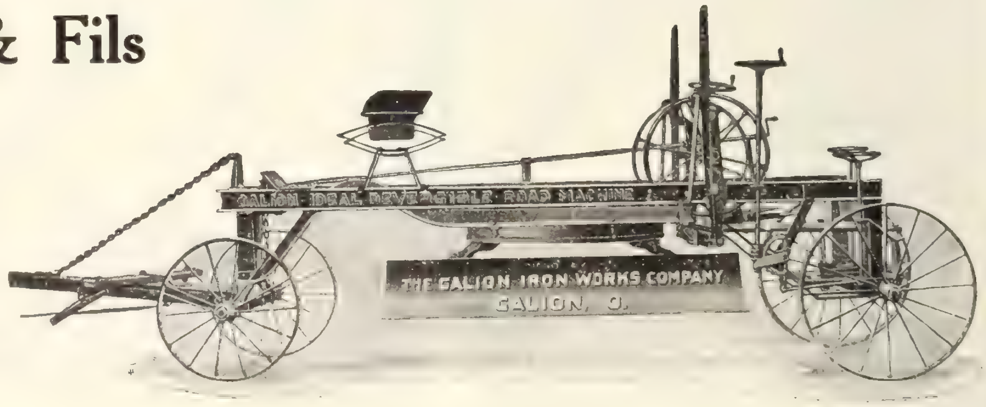
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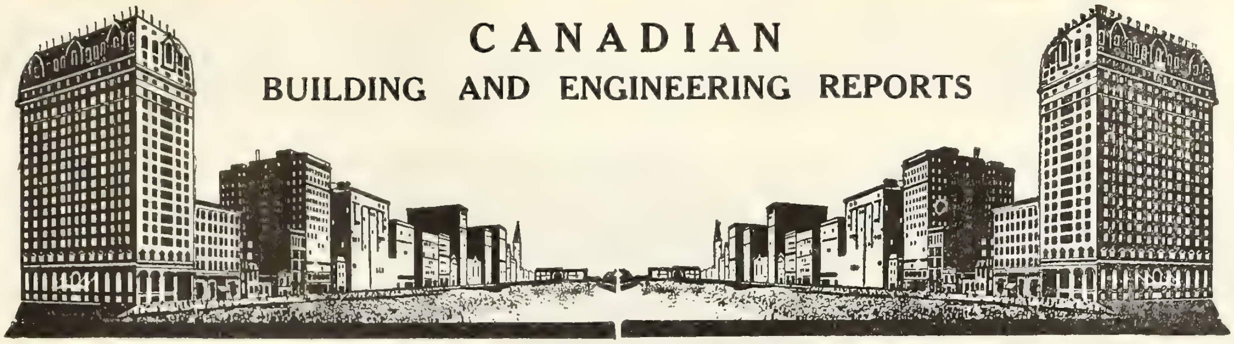

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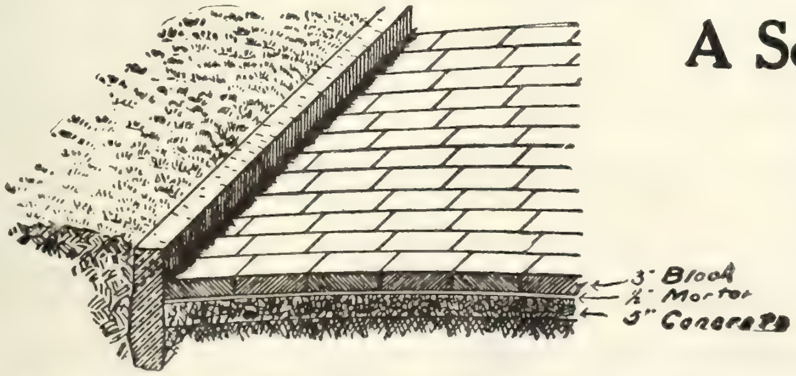

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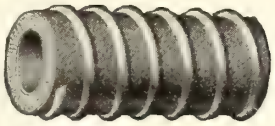
¶We build into Goodyear Hose the same strength and indestructibility as have made Goodyear Rubber Belts famous. Goodyear Suction Hose is steel-wound internally to guard against collapse. The coil is of round or flat wire, and round it the hose is built up, ply upon ply of rubber-permeated cotton fabric. This fabric is made from special hard-staple long-fibre cotton, and is cut on the bias to give strength and hard wear.

¶Goodyear Suction Hose is made for every purpose — and can be had rough or smooth bore. Is in service throughout Canada—on wrecking and dredging contracts—in factories and mines—on farms and in saw-mills. Special hose made for sand-sucking, oil, gasoline, vinegar and acid, wine, etc.



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¶Steam Hose gets more hard usage than any other hose. In the Boiler Room it lies around near the furnace and is scorched—a hot firing tool is carelessly thrown down upon it—oil is spilt over it.

¶Goodyear Steam and Hot Water Hose is made with special heat resisting lining, which keeps the extreme heat from the friction fabric. This gives the extra durability—it will stand up well under hard usage. In its manufacture the materials undergo special treatment to resist oil—so destructive to common hose. The rubber and duck used in Goodyear Steam Hose are specially tested for service under high pressure of steam and hot water. We supply it steel wire wound or marline jacketed.

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THE GOODYEAR TIRE

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¶When Mill Hose is wanted it is wanted badly. To find that your Mill Hose has cracked and rotted while lying idle is serious. **"Goodyear Underwriters"** is always ready for effective service. We build this hose to meet the requirements of the Associated Factory Mutual Fire Insurance Companies. It bears the required stamp of approval "tested to 200 lbs. pressure." The inner tube is made from N E W Rubber of the highest grade, uniform in thickness and quality. The cotton fabric is of special circular web woven to the Underwriters' specifications for a minimum of expansion or elongation under pressure. It is antiseptically protected against rot and mildew.

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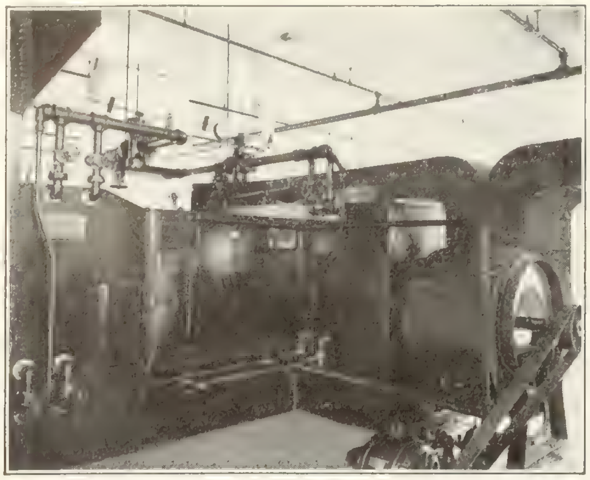

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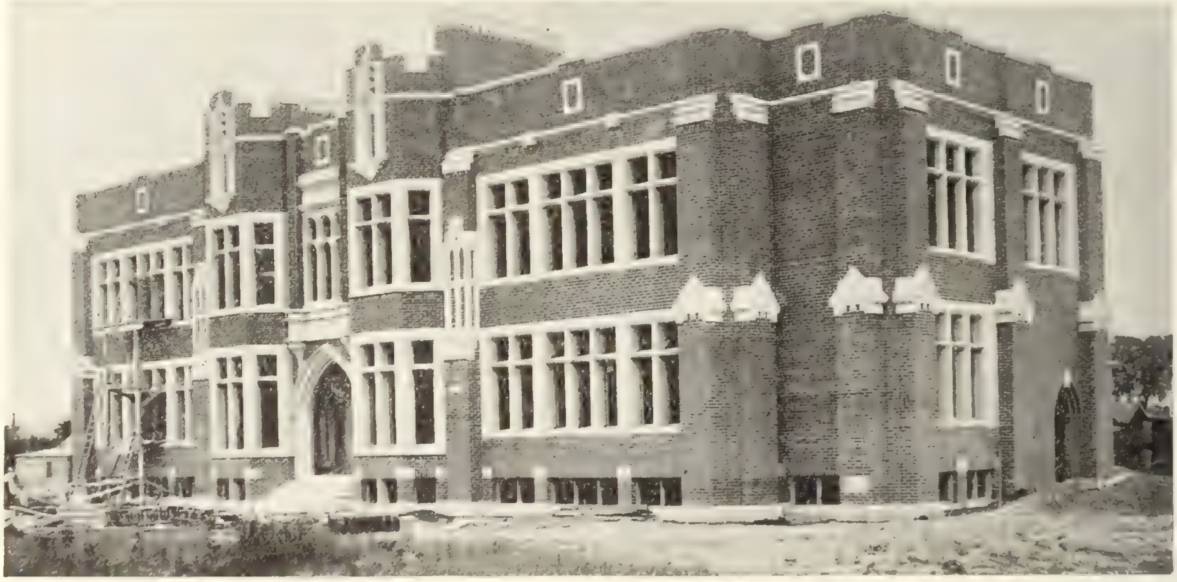

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Vol. 27 December 24, 1913 No. 52

Should Fees be Charged for the Use of Plans by Contractors Estimating on Work?

JUST at a time when contractors in the Canadian field have reached the conclusion that conditions under which they are tendering are far more strenuous, nine times out of ten, than occasion calls for, it is somewhat startling to happen across an article published under the above heading in a recent issue of the Engineering News. Our contemporary discusses the action of the Executive Committee of the General Contractors' Association of New York City in advising its members, by a resolution adopted, to discontinue the practice of paying for the privilege of estimating, whether under the guise of a deposit or otherwise.

It appears that certain architectural and engineering firms on the other side of the border have instituted the practice of charging a fee for the use of plans for estimating and that where insufficient plans have been prepared contractors have been charged for additional sets necessary for the completion of their contracts. In view of the recent editorial articles and discussions bearing upon this subject which have appeared in this journal, the observations of our contemporary are interesting.

The point of view from which an engineer should view the question raised, says The Engineering News, is the point of view of his client's interest. Is it or is it not for the interest of the client to charge a fee for the set of plans necessary for a contractor to use in order to prepare a close and careful estimate of the work on which he desires to bid? In public work, the letting of which is governed by statute, it is the general practice to furnish sets of plans free to any bona fide bidder. Where fees are charged, they are as a rule made nominal, merely to shut out those who desire to secure sets of plans for other purposes than bidding; or it is often the practice to make the fee merely a deposit, to be returned when a bona fide bid is filed.

The sound and valid reason for this practice on public work is that the work must be open to free competition, and that the charging of a fee for plans tends to discourage the submission of bids. The practice of requiring a certified check to accompany a bid is, of course, to prevent deposit of bids by irresponsible parties. This is not necessary, however, in the letting of private contracts where the principal or his engineer in letting a contract knows or can ascertain whether the bids submitted are bona fide, by responsible firms, and can discard bids from an irresponsible firm without any formality. To require every bidder to submit a certified check with his bid on a private contract, means the tying up of the banking funds of perhaps a dozen or a score of contracting firms for a period of perhaps a week or even a month while the bids are being considered and the award made. Further, misuse of such certified checks by the private parties receiving bids is always a possibility. We see, therefore, no good reason why such deposits should be required.

As for charging a fee for the use of plans required by bona fide bidders for estimating, it seems to us that there are few cases where the charging of such a fee will work in the long run to the interest of the party letting the contract. A good way to meet the situation where the detail plans involved in the work are exceedingly elaborate and expensive is to open the plans to inspection and study by contractors and their engineers in the office of the engineer in charge of the work. This can well be supplemented by preparing general specifications and general plans which can be cheaply reproduced in quantities by the phototype process and furnished free to any contractor who desires to look over the work in a preliminary way to decide whether he wishes to submit a bid.

We believe a little careful study of this matter by engineers will enable them to solve this problem to the advantage of both their clients and the contracting fraternity. It is no doubt true that a large expense is often incurred in making numerous sets of large blueprints for the supply of a large number of bidders on contract work. To charge a fee for these prints, however, simply distributes this burden to a number of contractors, only one of whom receives any return from the expenditure.

An Interesting Judgment Affecting Municipal Improvements

FROM Victoria, B.C., comes the report of an interesting judgment rendered by Judge Lampman in an appeal against a ruling of the Civic Court of Revision. Thanks to this judgment the owners on a number of streets on which underground conduits were laid, and against the assessments for which the owners complained, will not have to pay the levy made by the City.

The judgment held that as the work was carried out and completed early in 1912, but the customary advertisements indicating that the work was to be done were not published until October of the same year—thus preventing the owners to be assessed from objecting to the work if they so desired—the work was not done according to the provisions of the by-laws and the legal formalities were not carried out. An appeal was brought against the ruling of the Court of Revision, which, when the by-laws were being revised, refused to relieve the owners of the assessments.

In all there were thirteen by-laws before the recent Court of Revision. All of these provided for the assessment of owners for underground telephone conduits. The cost of the work was approximately $30,000 and doubtless there are other by-laws under which the work was carried out in similar manner. By the judgment of the court this cost must be borne by the city of Victoria. This phase of the question was considered by the Court of Revision, but the members thereof decided that if the owners objected to paying the assessments they could take legal action.

If the city pays the assessments levied against the owners—and in view of the recent decision there does not appear any other way out of the matter—the amount must be taken from general revenue. This will mean that next year's council at Victoria will be saddled with a tidy expenditure to come out of the revenue available for civic purposes in 1914.

Public Works—for Service or the Builder's Profit?

THE reasons for desiring the building of public works are of two kinds—first, a desire for the advantages that will grow out of the completed works, and, second, a desire for the advantages and profits of construction.

By common consent, only reasons of the first kind are officially and publicly urged in support of any given project, and it is well that this is so; but no one actively engaged in public work can be blind to the fact that reasons of the second kind are often—in fact much too often—more potent in securing actual results.

Both kinds of reasons may be legitimate. The contractor expects a profit and has the full right to look for what will yield it, and within reason to do what he can to advertise and promote the kind of works that he can build. The engineer and the architect, also, have a similar interest in the commissions that may come to them; and all those who may be employed, either by a public authority or by engineers and architects, or by contractors, have their interest in seeing matters move forward. Those who have land to sell, those who furnish all of the thousand kinds of supplies used in construction, and even the bankers who make a commission by the sale of bonds—all have an interest in seeing the expenditure of public moneys go forward.

Financial rewards are by no means the only ones that need be considered. The experience, the honor, the prestige, and the political power that come from carrying out works, especially when they meet with popular approval, are often potent in securing the cooperation of those who would not be influenced by financial considerations.

Up to a certain point all this is well and tends to progress and civilization. The danger lies in the chance that when the forces of construction that are necessary for progress are organized and developed they will come to have a dominating influence in the transaction of public business, and will secure the construction of public works that could not be justified from the standpoint of the results to be obtained from the finished works, and will do this for the sole, or principal, purpose of yielding the profits that grow out of construction. When a government reaches this stage it ceases to be a government for the people and becomes a kind of piracy in which the taxpayers are plundered.

There is need at this time as never before, in view of the slackness of private enterprise, of engineers and other citizens with breadth of view to rightly appraise the need for public works and with the honesty and courage to speak fearlessly concerning them.—Engineering Record.

Errors in Specifications

CARELESS proofreading is responsible for many inaccuracies in specifications, comments Engineering and Contracting. While most of these mistakes are unimportant yet there is a possibility that some of them might lead to serious results. In one specification that came to our attention two different dates were given on which the bids were to be opened. In the same document there was a mistake in the approximate quantities on which a comparison of the bids was to be based. The work included, among other items, about 300,000 cu. yds. of earth excavation. This amount, however, through error, was stated in the specifications as being 30,000 cu. yds. A mistake like this would be easily detected, but should it not be observed it might make some change in the standing of the bidders. With two contractors bidding 25 cts. and 24 cts. respectively on 30,000 cu. yds. there would be a difference of only $300 in their totals. But on 300,000 cu. yds. the difference would be 10 times as great, and this might be more than enough to offset the possible higher prices bid by the 24-ct. man on the other items of the contract. Mistakes through careless proofreading often occur in the papers for the preliminary steps for a public improvement. A few months ago a western contractor was "saved" from securing a $175,000 street paving contract by the discovery of his attorney that the council ordinance for the work called for the 'parking" of the street instead of the paving. The intention was plain, but the error got by the council committee, the city attorney, the city engineer, and the contractors, and was discovered only when the low bidder before signing the contract submitted the papers to his lawyer. In this case the whole proceeding had to be started all over again. The city council passed a new ordinance, the work was readvertised, and of course, this time, some other contractor got the contract.

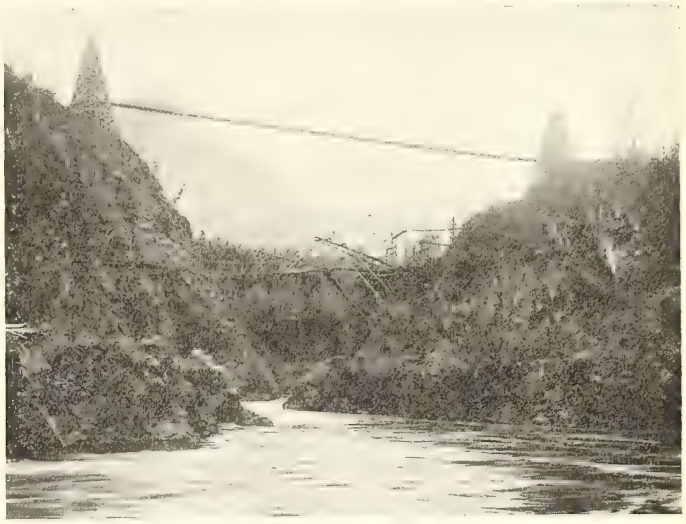
A new "skyscraper" is to be erected in New York which will reach the colossal height of 901 ft., and is to form the permanent exhibition centre for the combined republics of America. The first floor will be an enormous hall, 200 ft. square and 30 ft. in height, which will always be used for purposes of exhibition of machinery. The second floor will be set apart for weekly exhibitions of local manufacturers, and the industries of north, south, east and west will be assigned a separate floor for their products. Four floors are to be set apart for the Latin-American Republics, the larger having each of them an entire floor, while the smaller will be grouped together two or three on a floor. Above these seven floors will be devoted to offices to be let to exporters, merchants, attorneys, and others whose business is connected with the Latin-American peoples. There will be a library devoted to books referring to Latin-American countries, and a floor will be given up to statistics and reports on American commerce, while space is to be provided for dining-rooms, conference rooms and lecture halls.

Large Single Span Suspension Bridge at New Hazelton, B. C.

THE new high level bridge which has recently been built across the Bulkley River Gorge at New Hazelton, B.C., by Geo. Cradock & Company, of Wakefield, England, and Vancouver, B.C., is one of the biggest single span suspension bridges in the world. It is also among the highest suspension bridges in Canada, being erected at a height of 250 feet above water. The bridge is one of Cradock's special stiffened structures, and is the first of its kind to be hung from catenaries of locked coil cables which do not rotate nor lengthen. The contract was awarded in the latter part of 1912, but owing to the severity of the northern winter it was impossible to undertake the work of excavating and erecting the foundations until the following spring.

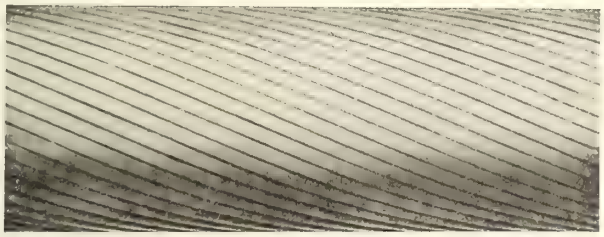
On account of the delay in making a start on the excavation it was considered advisable for Mr. Percy Cradock, one of the directors of the contracting firm, to come out from England and give the matter his personal attention. Mr. William Spencer, the company's chief engineer, also journeyed to British Columbia and acted as superintendent of the work until its completion last September. The length of time required in actual construction was only about two months, no difficulties whatever being encountered after the foundations had been completed. All the steel parts were sent out from England and fitted together perfectly, no undue strain being put upon the structure on this account.

The bridge is the first to be erected in any part of the world in which Cradock's locked coil cable has been used. As already mentioned, it is at an elevation of 250 feet above water-level of the Bulkley River, spanning the river at a point where it is confined between the walls of a rugged canyon. The length of the single span is 451 feet, but with the approaches the total length of the structure is 600 feet. The bridge is suspended from timber towers, one of which is erected on a concrete pier, while the other is on solid rock. The cable used in construction is Cradock's locked coil steel wire rope, 2½ inches in diameter, and the bridge is cap-



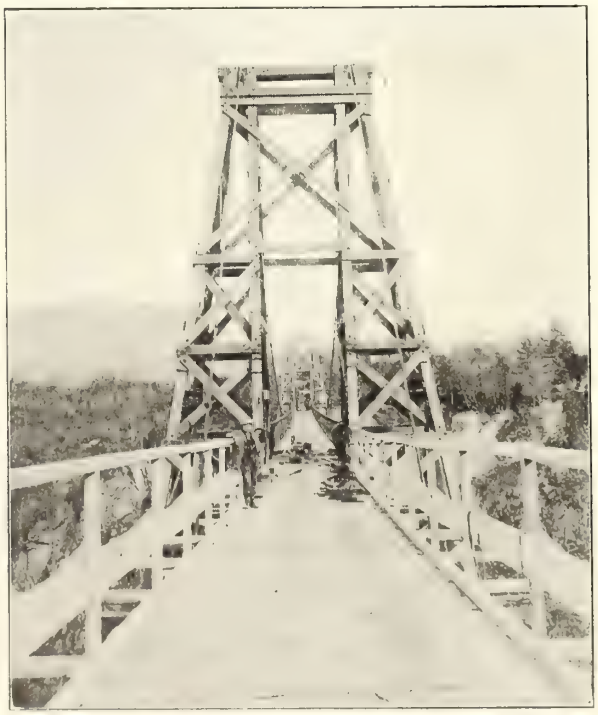
Suspension bridge across Bulkley River, New Hazelton, B. C., showing old cantilever bridge, formerly occupying the site, built by Indians.

sides with four 3-in. steel bolts, two to each cable, and buried in blocks of concrete measuring 15 by 21 feet and weighing 150 tons approximately. The sides of the bridge are supported by stiffening steel girders of able of carrying a movable load of 18,000 pounds. At each end of the bridge the cables are anchored on both



Locked coil cable used in construction of suspension bridge across Bulkley River

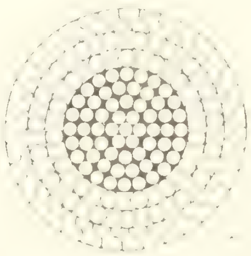
Suspension bridge across Bulkley River.



Roadway of suspension bridge across Bulkley River at New Hazelton, B. C.

lattice type, extending from the hand rails to the floor. The suspension rods are three-quarters of an inch with the screw bottoms thickened to seven-eighths of an inch, and are fastened to the suspension cables by clamps. These rods are placed four feet apart on either side, and at their lower extremities carry the bearers of the bridge, which are also of steel placed four feet apart and diagonally braced with steel angle iron. Fifty tons of steel have been used altogether in the construction. The towers are sixty-five feet six inches high, and the bridge is nine feet wide in the clear. The locked coil cable used in construction has a breaking strain of 350 tons. The floor of the bridge consists of 3 x 4-inch plank, laid on stringers 4 x 7 inches, resting on the steel bearers. All timber is of the best Coast fir. The accompanying cuts illustrate the work under construction, side and end views of the completed bridge, and in the side view is to be seen the cantilever bridge built by the Indians, which has withstood the winter snows, storms and traffic of many years. This old Indian bridge is one of the world's curiosities in engineering among primitive people, and the manner of its testing was as peculiar as the bridge itself. When it was completed the native builders placed a number of squaws on it to ascertain whether it would carry the load, and it was then passed for traffic.

The contract for the new bridge was carried out for the New Hazelton Bridge & Power Company, organized in Vancouver to protect the interests of New Hazelton. The structure fills a long-felt want in providing transportation in the Bulkley Valley. Erected in practically an undeveloped section of the province, amidst magnificent scenery, it suggests a useful type for bridges for crossings under similar conditions in British Columbia, Alaska and the Yukon.



Section of locked coil cable used in bridge across Bulkley River.

The work was completed before the government wagon road crossing the bridge had been surveyed, but as a result of petitions being sent to Victoria, road building operations were inaugurated without delay and the bridge is now available for traffic.

The new passenger station of the New York Central & Hudson River Railroad at Rochester is a large steel frame building occupying a triangular site one block east of the old station. The most important structural feature is the 122 x 156-ft. roof over the main waiting room. This is carried on four pairs of three-hinger steel arch trusses of 90 ft. 8-in. span supported in an unusual manner by long vertical and inclined posts engaging their skewback pins. The building contains 910 tons of structural steelwork, including 250 tons in the roof, all of which was fabricated and erected by the Buffalo Structural Steel Company. The roof trusses weigh 22 tons each, and each semi-truss was shop riveted in two sections. The station was designed and erected under the joint direction of Mr. Claude Bragdon, of Rochester, the associate architects of the railroad engineering department, and Mr. G. W. Kittredge, chief engineer, and Mr. J. W. Pfau, engineer of construction, of the New York Central & Hudson River Railroad. Mr. F. E. Paradis, district engineer of the Western district, was in charge of all construction and Mr. J. B. Reinhardt was resident engineer. The steelwork was designed by Mr. J. L. Miller, assistant engineer.

Observations on Bridge Expansion

THE question of bridge expansion has a number of doubtful points: (1) Some engineers regard expansion provision as a more or less unnecessary refinement and believe that bridges and similar structures of steel do not change in length perceptibly under varying temperature conditions. (2) While it is known that a straight bar of steel will expand or contract under temperature changes uniformly at the rate of 0.0000067 per degree F., there are no recorded observations to show that the same expansion-coefficient applies to a complex structure like a bridge, which contains joints, etc.

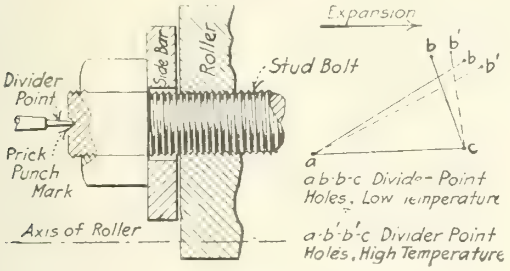
Three years ago the writer made a series of observations of steel railway bridges erected on various lines of the New York, New Haven & Hartford R.R., to determine the action of the expansion bearings. The bridges on which the observations were made are all relatively new, having been erected during the past ten years. In all, forty-five observations were made, on as many different bridges. Of these 16 were pin-connected trusses, varying in length from 182 to 217 ft.; 11 were riveted through trusses, 70 to 145 ft. in span; and 18 were deck plate-girder bridges, 70 to 111½ ft. in span. The winter temperatures during which observations were made (1910-11) ranged from + 15 to + 56 deg. F., and the summer temperatures (the following summer) ranged from 45 to 86 deg. F. The variation from high to low temperature during a single set of observations ranged from 18 deg. change as a minimum to 54 deg. change as a maximum.

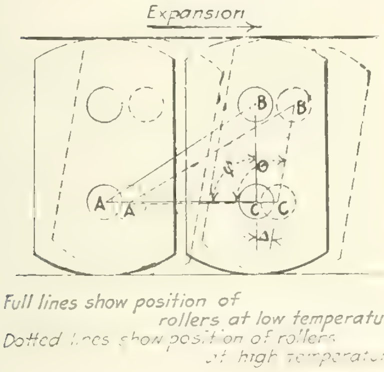
In all the through bridges observed upon, the floors were of the standard floorbeam-and-stringer construction; the deck plate-girder spans had the roadbed supported directly on the girders. The roller nests were in all cases made up of 6-in. segmental rollers connected by pairs of parallel side bars attached to the rollers with studs; the bearing surfaces of the shoes were planed.

The method of obtaining reliable measurements of the small expansion movements is illustrated by the adjoining sketch. Prick-punch marks were made in the centres of three studs in two adjacent rollers, and the distances between the marks were measured by a pair of dividers. The divider measurements were not read off on a scale, however, but were transferred directly to the pages of a notebook by pressing the divider points into the page. The second reading was recorded in this way on the same page on which the first reading (at lower or higher temperatures as the case might be) had been recorded. It was an easy matter to compute or work out graphically the angular movement of the rollers as represented by the two measurements and therefrom determine the expansion or contraction as a linear measurement.

To compute the coefficient of expansion, it was necessary to know the temperature of the bridge at each observation. It might be thought that very precise temperature readings would be necessary, but the following observation indicated that this was not the case: a 217-ft. pin-connected truss span was watched while the atmospheric temperature was rapidly rising under the warm rays of the morning sun. It was noted that a movement occurred at the roller bearing for every 3 to 5 deg. F. rise in temperature, and whenever such a movement occurred there was a loud noise. The bridge and its bearings were in good condition. It is concluded from the observation that, even under nearly ideal conditions of free movement, the expansion movement of a bridge does not take place smoothly and continuously. If this is true, great precision in the temperature readings is an unnecessary refinement, adding nothing to the accuracy of the final results. The noise accompanying the successive expansion movements suggests that there was an accumulation of expansion stress in the bridge prior to a movement.

The temperature readings were therefore confined to readings of the air temperature. In a few cases the bulb of the thermometer was in actual contact with the steel, but the readings then were practically the same as the readings taken with the thermometer bulb free from the bridge. It may be true, perhaps, that the actual temperature of the steel is somewhat lower an hour after sunrise than the temperature of the surrounding air (or similarly, higher than air temperature an hour after sunset); but the observations were all taken between 10 a.m. and 5 p.m., and during this part of the day it is believed that the internal temperature of the steel and the temperature of the surrounding air are very closely the same, in view of the large exposed surface of bridge members and the rapid transmission of heat through iron. Moreover, any attempt at accuracy in measuring the temperature of the steel would be nullified by the fact that at any time of the day some parts of a bridge are shaded while others are exposed to the direct rays of the sun, which makes it a question at what point of the bridge the temperature of the steel is to be determined.


Expansion
Side Bar
Roller
Stud Bolt
Divider Point
Prick Punch Mark
Axis of Roller
b
b'
b
b'
a
c
a-b-b-c Divider Point Holes, Low Temperature
a-b'-b'-c Divider Point Holes, High Temperature


Expansion
B
B
A
A
C
C
Full lines show position of rollers at low temperature
Dotted lines show position of rollers at high temperature

The following table gives the results as regards coefficient of expansion obtained from the three classes of bridge observed upon. These three values, while differing somewhat among themselves, are closely enough in agreement with the generally accepted coefficient of expansion of steel to warrant the conclusion that a bridge expands just like a solid bar. Whether the lower value obtained for the pin-connected trusses is due to play in the joints may be a matter of opinion.

Conclusions

(1) The coefficient of expansion for an assembled bridge structure is practically the same as the laboratory coefficient of a specimen of the same material.

(2) Expansion bearings of steel segmental rollers 5 to 7 in. in diameter properly connected by parallel side-bars and rolling between planed steel surfaces are effective and will take care of all expansion and contraction with at best a very slight amount of secondary stress in the members of the bridge. From other observations, however, it is concluded at the same time that rollers less than 2½ in. in diameter under light steel highway bridges are not effective for any length of time.

EXPANSION COEFFICIENT OF STEEL RAILWAY BRIDGES

Number of observations	Type of bridge	Average variation in temperature	Observed coefficient of expansion
16	Pin-connected	39° F.	0.0000053
11	Riveted	30° F.	0.0000064
18	Plate-girder	44° F.	0.0000063

(3) A steel cog or other mechanical device to connect the rollers with the bearing plates in such a way as to compel them to turn is unnecessary. The observations showed that rollers without this device acted with just as much freedom as those having it. In neither case was there any sliding.

Improper Placing of Rollers in Erection

During the observations described above, the roller bearing of one bridge (not included in the series reported above) was found with the rollers in such tight contact that it was difficult to detect any parting line between them. This was observed at a temperature of 27 deg. F., and the axes of the segmental rollers were inclined away from the middle of the bridge, so that it was quite out of the question for the bearing to accommodate a further increase in truss length. This bridge was 160 ft. in span, a heavy double-track bridge erected about five years ago. The rollers were 6 in. in diameter. The position of the rollers was doubtless due to carelessness on the part of the erector when setting the rollers. It is easy to imagine that when the temperature rises to 100 deg. F. this bridge will be compelled to slide on its bearing plates.

Erectors should be cautioned to give the setting of the rollers careful attention, and to set the rollers according to the temperature at the time of erection, so that the maximum elongation and contraction counted upon can actually be accommodated.

Roller nests under trusses are machines—a combination of moving parts—to perform certain work. They should have the same attention and consideration as any other machine exposed to the weather. Owing to the fact that the position of rollers makes them practically inaccessible after erection they receive little or no attention during the life of a bridge. In winter they are surrounded by snow and ice which thaws and keeps them moist. Usually there is little provision for drainage and the conditions for corrosion are ideal. Sometimes sticks and stones get into the roller nest and help to prevent movement. Bearings should be designed so that these conditions will be avoided. Maintenance cannot be depended upon to keep roller nests in perfect condition.—H. A. Loser in The Engineering News.

Bituminous Surface Treatment and Dust Preventive*

By William H. Connell

BITUMINOUS surface treatments and dust preventives should be divided into two main divisions, each with a sub-division, and for convenience they will be classified as follows:

1.—Bituminous surface treatment designed to waterproof and act as a wearing surface on waterbound macadam, gravel, shell, slag, and dirt roads.

1a.—Dust preventives for waterbound macadam, gravel, shell, slag, and dirt roads.

2.—Bituminous surface treatments designed to waterproof and rejuvenate old bituminous pavements, sheet asphalt, asphalt block, and wood block pavements, and to be used as a wearing surface on concrete and old brick pavements.

2a.—Dust preventives for standard types of pavements; commonly used in municipalities, such as ordinary water sprinkling, washing with squeegees, and flushing. (For convenience in this paper bituminous pavements will refer to pavements consisting of stone, or stone and sand mixed with a bituminous binder, built by penetration or mixing method.)

The first classification applies more generally to country roads and the second to town and city pavements. There is so much overlapping, however, in the handling of these respective classes of highway work, that a highway engineer should be familiar with all branches of highway work in connection with both roads and pavements, and it is therefore desirable to take this subject up as a whole rather than confine it to country roads.

Materials and Conditions

The use of bituminous surface treatments and dust preventives on country roads has now become so general that there is no longer the mystery attached to the respective merits of the bituminous materials and dust preventives in general use that has existed in the past; in fact, we have reached the point where there are more or less standard methods of treatment for the different types of roads and, by making a careful study of its condition, it is not difficult to determine upon the best available treatment suited to the road in question, based upon former treatments of similar roads under like conditions. Therefore, as far as the materials in general use are concerned, we can get a more or less satisfactory treatment for all classes of macadam, gravel, dirt, and shell roads, but we have by no means reached the point where we have an ideal treatment for such roads. We have, however, reached the point where there is no necessity for extravagant waste in connection with our surface treatments, and going on the theory that an ounce of prevention is worth a pound of cure, it is far better to employ expert advice in connection with work of this character than to have inexcusable and disastrous failures due to the use of bituminous materials not adapted to the conditions, or the conditions not being satisfactory for bituminous surface treatment. The principal cause of the numerous failures is that there is too little attention paid to this phase of the situation and, as a matter of fact, it is just as necessary to employ expert advice in connection with this work as in any other branch of engineering work.

New materials and methods of treatment resulting from laboratory experiments and research work should be developed through experiments on sections of roadway of sufficient length, rather than through wholesale use, which may or may not result in a failure, and in fact, more often does result in a failure on first trial. There have been numerous papers and discussions on the subject of bituminous surface treatments and dust preventives in the past five years and while there were wide differences of opinion concerning the respective merits of the available bituminous materials and dust preventives, and the proper methods of treatment in the early papers on the subject, a review of the papers written by recognized authorities within the past two years shows that insofar as the treatment of country roads is concerned there is little if any difference of opinion concerning the underlying principles that should govern the selection of materials and the preparation of the road for surface treatment. This being the case, a great deal of repetition can be avoided and a better understanding reached by formulating standards relating to the elementary principles of the selection and the use of bituminous surface treatments and dust preventives for country roads. This will result in stimulating scientific research, and the development of new thought in the other phases of this all important subject, namely—the bituminous materials which are shrouded in so much mystery, due in part to trade conditions, and in which the advance has not been commensurate with the possibilities in the past two years. We are face to face with this problem and our progress within the next few years depends upon bettering the bituminous materials and dust preventives now in use. As it is assumed you are familiar with or have read articles by recognized authorities covering the underlying principles relating to the selection and application of bituminous materials and dust preventives on different types of country roads, this phase of the subject will close with the following summary of work of this character done in Philadelphia during the past year.

During the year 1913 the Bureau of Highways treated 415,000 square yards of waterbound macadam with various tars and asphalt cut-backs, at a cost of .049c to .10c per square yard. The high cost for some of this work was due to several reasons; first, the work was widely scattered throughout the entire city and in a large number of cases only consisted of one or two blocks, making it very expensive to move the gangs and equipment from place to place. Second, lack of experienced men to handle the work, and third, on account of the high cost of suitable top dressing available in this locality. The material used was a Torpedo sand passing a ¾-in. screen with not over 10 per cent. passing a No. 20 sieve, which cost from $2.50 to $2.75 per ton delivered on the road. This is also the standard price for clean trap rock chips in this locality. The labor cost for sweeping and chipping ran from .007c to .036c per square yard, and chips and gravel from .018c to .048c per square yard, bituminous material from .013c to .045c per square yard applied. The cost of the bituminous material was as follows: Tarvia A .085c, Tarvia B .07c, Ugite 1-C .07c, and Ugite No. 3 .08c; asphalt cut-back, .12c per gallon applied.

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*Paper presented at the tenth annual convention of the American Road Builders' Association, Philadelphia. December 9-12, 1913.

Realizing the importance of cleaning the macadam thoroughly before applying the bituminous material, both hand and machine brooms, as well as scrapers were used, care being taken to remove all dust and dirt so that the stone was absolutely bare, after which the bituminous material was applied in quantities of from 1/3 to ½ gallon per square yard. Wherever possible the road was blocked off and the material allowed to penetrate for a matter of twenty-four hours before chipping. If traffic conditions would not permit blocking the road for this period of time, it was chipped before stopping work for the day. The quantity of chips applied averaged from 13 to 14 lbs. per square yard, depending upon the amount and character of the bituminous material used. Every effort was made to avoid creating a pad on the macadam surface, especially on heavy grades. Where the bituminous material was applied during the cold weather very little, if any, penetration was secured, which resulted in a thin pad. Several old tar penetration sections were treated with a light application of about one-quarter gallon per square yard of tar and then chipped, which in most cases has put the road in good condition and will undoubtedly lengthen its life for a period of a couple of years.

The asphalt cut-back consisted of 65 per cent. of asphalt with a penetration of 140 to 160 at 77 deg. F., cut back with 35 per cent. of commercial naphtha with a gravity of 53 to 55 Beaume. This was applied in quantities of from 1/3 to ½ gallon per square yard. The naphtha acted as a carrying agent and in most cases a penetration of about ¾ in. was obtained, depending upon the temperature. The material was applied cold and in some cases it was fired immediately after the application, burning out the naphtha, which resulted in an immediate set in the asphalt and up to the present time the results have been very satisfactory. The results obtained from the various tars used have been very satisfactory with the exception of a few sections which were applied late in the Fall and which we believed contained too large a percentage of asphalt in the tar, causing a very mucky condition after each rain.

Avoid a Pad

The primary consideration pertaining to the application, all other conditions being satisfactory, was to avoid a pad, the object being to waterproof the surface of the roadway and use just enough material for this purpose, so that the surface would wear off uniformly and be in condition for a new application when necessary, instead of having it creep and pit in spots, which is often the case with a bituminous pad and which is very difficult to satisfactorily repair. The selection of the bituminous materials used in each case was governed by the fundamental or underlying principles covering this phase of the subject.

The tar treatments were applied hot and cold under pressure, depending upon the material used. In the case of the material applied cold about one-third to one-half gallon per square yard was used, while in the case of the hot application from one-quarter to one-third gallon was used. The cost of the cold application of tar averaged .067c per square yard, while the hot application averaged .087c per square yard. These costs are high, notwithstanding the high cost of top dressing in this locality, due to this class of work being new to the organization performing the work. Other materials used were Gluterin, which was diluted by adding 50 per cent. of water and applied at the rate of one-half gallon to the square yard, and calcium chloride and asphaltic oil, of about 18 to 21 Beaume gravity, applied at the rate of one-quarter gallon to the square yard. These two latter materials were used simply as dust layers.

With regard to the vast field coming under the head of the second division, that covering the more permanent types of pavement, little progress has been made in treatments designed to waterproof and rejuvenate old sheet asphalt and such types of pavements, except possibly in St. Louis, Mo. It is far from exaggeration to say, however, that large sums of money (resulting from prolonging the life of, particularly sheet asphalt and asphalt block pavements) can be saved by suitable surface treatment on old pavements of this type requiring such attention. The same can also be said of old bituminous pavements built either by the penetration or mixing methods, and a great deal of work of this character has been done in Philadelphia this year. Considerable experimentative and research work, however, has been carried on in connection with bituminous surface treatments on concrete throughout the country without entirely satisfactory results. The following experimental bituminous surface treatments on concrete have been laid on the Service Test Road (Byberry and Bensalem Turnpike) this year.

Section 3, Station 47-00 to 50-00: One-half gallon per square yard of Pioneer Road Surface Asphalt was applied at a temperature of 350 degrees, covered with clean trap rock chips passing a ⅜-in. screen and rolled with a 6-ton tandem roller.

From Station 52-50 to 54-58, a bituminous top of Ugite was applied. After sweeping the surface of the concrete, 1/6 gallon per square yard of Ugite A was applied by hand and ⅜ gallon per square yard of Ugite No. 3 was then applied, at a temperature of 280 degrees, by a pressure distributor. A coating of ¾-in. dry trap rock chips followed. Another application of ¼ gallon per square yard of Ugite No. 3 was then applied, at a temperature of 280 degrees, by a pressure distributor, which in turn was covered with Torpedo sand and rolled with a 12-ton three wheel roller.

From Station 54-58 to 57-17, a bituminous top of Tarvia was applied. After sweeping the surface of the concrete, ¼ gallon per square yard of Tarvia B was applied cold, after which ⅜ gallon per square yard of Tarvia A was then applied, at a temperature of 250 degrees, with a pressure distributor and covered with Torpedo sand.

From Station 57-17 to 59-50, a bituminous top of Texaco asphalt was applied. After sweeping the surface of the concrete, ⅛ gallon per square yard of Texaco asphalt cut-back with naphtha was applied by hand, after which 6/10 gallon per square yard of Texaco asphalt, 55 penetration, was applied by hand at a temperature of 450 degrees and covered with clean trap rock chips passing a ¾-in. screen and rolled with a 12-ton three wheel roller.

From Station 87-50 to 92-00, a bituminous top was laid. From Station 87-50 to 90-00, 4/10 gallon per square yard of Dolarway bitumen was applied at a temperature of 207 degrees and covered with Torpedo sand.

From Station 90-00 to 90-70, ⅛ gallon per square yard of Bicomac was spread on the surface of the concrete pavement. A mixture of trap rock chips, trap rock dust and Bicomac was then applied and rolled with a hand roller. One-half of this surface was covered with trap rock dust and rolled lightly. The other half was covered with trap rock chips and rolled lightly.

From Station 90-70 to 91-35, 4/10 gallon per square yard of asphalt cut-back with naphtha was spread upon the surface of the concrete pavement and the naphtha burned out. Trap rock chips were then spread and rolled into this asphalt coating with a hand roller.

From Station 91-35 to 92-00, ⅛ gallon per square yard of Bicomac was spread upon the surface of the concrete pavement, after which 4/10 gallon per square yard of asphalt was applied at a temperature of 400 degrees and covered with clean trap rock chips.

Section 14, Station 112-50 to 118-00; One-quarter gallon per square yard of Ugite No. 3 was applied here, at a temperature of 250 degrees, by a pressure distributor, which was covered with clean trap rock chips passing a ½-in. screen and rolled with a 6-ton tandem roller, after which ¼ gallon per square yard of an asphaltic cement was applied, at a temperature of 425 degrees, by a pressure distributor and covered with clean trap rock chips passing a ½-in. screen and rolled.

The methods used to do away with the dust nuisance on the more permanent types of pavements are thorough cleaning, preferably washing with squeegees, flushing with pressure flushing machines or a hose. The field for the class of work coming under the subject of this paper and covered by the second division has been only lightly touched upon in this paper, and, as a matter of fact, has not, generally speaking, been given the attention throughout the country that it deserves, excepting bituminous surface treatments on concrete.

In conclusion it might be well to add, that after all is said and done we only too often have to cut our cloth according to our pockets and cannot always use the type of bituminous surface treatment and dust preventive we prefer, but, even so, there is such a thing as doing the best we can under these conditions and if whatever may be done is the result of careful consideration, embodied with personal knowledge on the subject or advice from some recognized authority, conditions can always be bettered.

Moving Loads on Steel Bridges

Consideration of Stresses Produced by Train Crossing Truss and Girder Spans

INVESTIGATIONS of the stresses produced in steel railroad spans by locomotives and trains moving across them, at different speeds, have been in progress at Washington University since 1906, and a review of them recently published by Mr. E. O. Sweetser, assistant professor of civil engineering, does not warrant final conclusions, but indicates that impact stresses increase with the speed of the locomotive, but do not appear to have any fixed relation to it for short spans.

In 1906 records were made by students on stresses in a 150-ft. pin-connected single track Pratt truss span built in 1883 with suspended floorbeams and light lateral and floor systems, The investigators concluded that "the present formulae seem to be extravagantly generous in the allowance for impact." In the light of subsequent investigation Professor Sweetser believed this to indicate something radically wrong in the assumptions made as to the distribution of static stress.

Additional experiments on the same bridge in 1907 lead to the conclusions that for "speeds up to 15 miles per hour there is no increase of stress; for speeds up to 36 miles per hour there is an increase of 25 per cent., and for speeds up to 45 miles per hour there is an increase of 30 per cent. in stress."

In 1910 and 1911 tests were made on three bridges under the direction of Professor Sweetser. The records were made both under regular traffic and under special trains consisting of a freight locomotive followed by four or five heavy cars run across the bridge at different speeds. The stresses were indicated by special extensometers recording the elongation in a measured distance of 50 in. These two instruments magnified elongations about 56.5 and 59.5 times and recorded the amounts by a pencil moving on paper transverse to the direction in which the paper was moved automatically by clockwork. The speed of trains was determined by timing them with a stop watch over measured distances of 500 ft. for high speed and from 100 to 200 ft. for low speeds.

About 300 records were made of the effects of trains passing over three 153 ft. 1½-in. riveted through-truss single-track spans of bridge 18.2 of the St. Louis & San Francisco Railway at speeds varying from 2½ to 50 miles per hour. This bridge replaced the one previously tested, and had heavy members capable of resisting both compression and tension stresses. Most of the records were made on the center span. The lower chords, main diagonals, one suspender, top chords, secondary verticals, and end posts were tested.

About 50 records were taken of train loads on the single track deck-plate girders, 69 in. deep, in a two span bridge for the Missouri Pacific Railway. The extensometer was placed on the tension flange of the girder at the center of the span. The speed of the trains varied from 7 to 51 miles per hour.

About 200 records were made of train loads on the 36-in. plate girders for a 33-ft. deck single-track span of the St. Louis & San Francisco Railroad, the extensometers being placed on both inner and outer flanges.

About 300 records were made of trains on two spans of 52-ft. deck plate girders 69 in. deep with a track curved 2 deg.

The analysis of the results of the tests and the curves from them indicate that the distribution of stress in plate girder flanges is not at all uniform and that considerable impact often exists for short spans at speeds of 10 miles per hour, and that such a speed does not necessarily give a static stress.—Engineering Record.

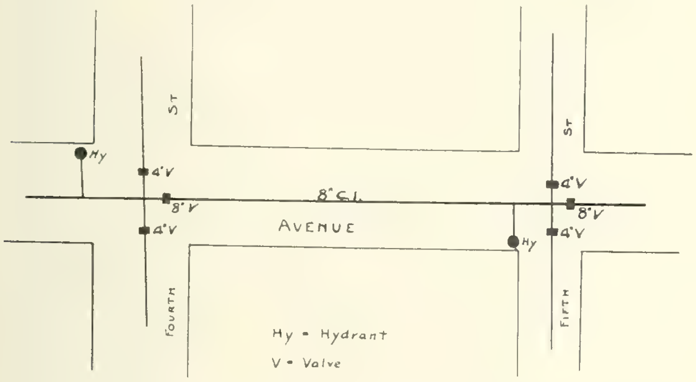
Large drain tile show blisters even before they go into the kiln. This is due quite often to the presence of mica in the clay. Mica is greasy and slippery and fails to unite properly with the clay. Blisters form at these places. While burning they open up. An extension on the tile press, between the clay cylinder and the die, permits the clay to travel further, giving it the time to unite before issuing from the die. This, as a rule, overcomes blister trouble.

Nanaimo Water Supply

THE City of Nanaimo is frequently called the industrial and distributing centre of Vancouver Island. It is also the centre of the coal mining industry and its resources in this respect are said to be practically unlimited; so, too, fortunately, is its water supply.

The continued steady growth of the city can be readily ascertained from the increased numbers in the "tappings" of the water mains, these have been so persistently increasing that an additional pipe line has had to be laid from No. 1 dam to the city. The water supplied to Nanaimo collects on the snow-capped mountains at the source of the Nanaimo River, some twenty miles away, consequently even on the hottest day of summer the drinking water is cold, pure, sparkling and abundant.

A corporation water works loan by-law sanctioned the expenditure of $50,000 on the construction of an 18-in. wooden water main and the general improvement of the distribution system of the district. Before any construction work took place the following important details were decided by the Water-Works Commission: (1) That the plan of the proposed unproved distribution system be adopted, and the work carried out according to the scheme laid down. (2) That the water mains on all principal residential streets be not less than six-inch diameter with four-inch diameter laterals on less important streets. (3) That all mains should be under separate control for each block (see tracing) and that no "dead" ends be allowed, but all pipes to be in circuit, and hydrants placed at the corner of each block.



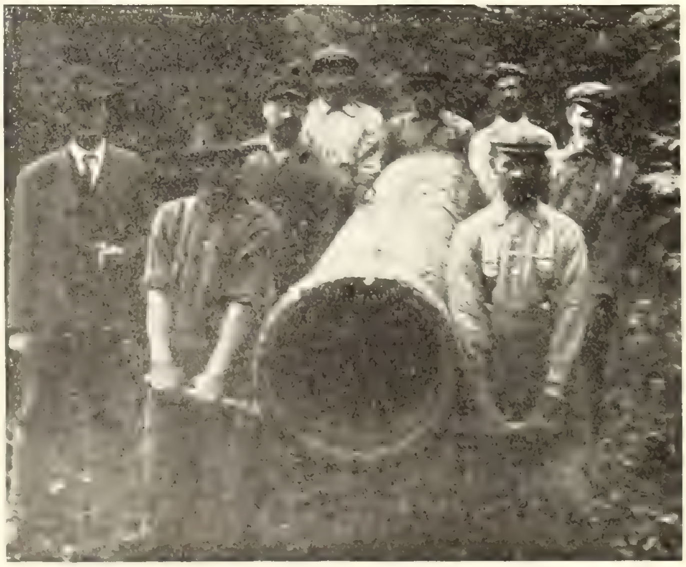
The total length of 18-in. diameter pipe laid from No. 1 dam to the city was 10,800 feet, the pipe being supplied by the Dominion Wood Pipe Company, Limited, New Westminster. The whole of the excavating and filling was done by the city workmen. Unfortunately at about two thousand feet from the dam a large amount of conglomerate rock was met with in what to all appearance was simply an alluvial soil. This conglomerate is perhaps the most difficult rock to deal with from an excavator's point of view. It is simply Nature's concrete of first-class composition. Blasting has little effect on the rock except to form pop holes and it is a matter of slogging and "burning" out the conglomerate. At the outlet from the dam a reinforced concrete chamber, approximately 8 ft. x 6 ft. x 6 ft., was built. The top was formed of reinforced concrete with a cast-iron cover which is secured with gunmetal bolts. This chamber holds the screens and also acts as a flush chamber when so required. The line of pipe was practically straight, with one or two sharp angle turns. One of these was made in wooden pipes of short lengths (see sketch) and the other by a special casting.

Nanaimo water supply—showing dense bush through which the pipe was taken.

To provide for further extensions of the distribution system, five cast-iron crosses, 18 in. x 18 in., were put in. This obviates the necessity of tapping the wooden main at any time. Valves have been placed at each branch and these can be taken through the sub-divisions as the population increases.

One of the great drawbacks to the cities in the Far West is that of obtaining a quick delivery of supplies and the firm of iron founders who have the intention to lay in a stock of standard supplies for water main and fittings on this side of the continent will readily find a good demand.

"Brick is the best kind of pavement that our experience has been able to develop, on account of its moderate first cost, its smoothness, wearing, qualities, light maintenance expense, and the ease with which it can be cleaned. I regard our 600 miles of brick pavement in the city and 400 miles of rural brick highways in the country as a distinct commercial asset worth many times what it cost."—Newton D. Baker, Mayor of Cleveland.



Method of carrying pipes to trenches, Nanaimo, B. C

Methods of Heating Various Types of Buildings

Contributed by Harry H. Angus, Consulting Engineer, Toronto

HEATING and ventilation may be accomplished by the use of hot air, hot water or steam, as the medium for carrying the heat. The question of deciding upon the best medium to use depends largely on the type and size of building in which the heating plant is installed. Generally speaking each system has its special field, although this is not always the case.

In general, buildings may be divided into four main divisions as follows:—(1) residences; (2) schools and public buildings, in which ventilation as well as heat is required; (2) buildings, such as factories, warehouses, etc., in which no ventilation is required; (4) buildings in which the ceilings are very high, such as boiler shops, foundries, and some large churches.

Taking these buildings in this order, we have residences as the first division. These are almost always heated either by hot air furnaces or by the hot water gravity system.

The main points in favor of the furnace system are: (1) low cost of installation; (2) heating combined with ventilation; (3) the rapidity with which the system responds to light service. In case of dwelling houses a furnace can be installed for about one-third the cost of any other system. It is also quite evident that ventilation may be very easily obtained with this system. In order to do this, it is only necessary that the furnace draw its supply of cold air from outside. The amount of fresh air entering may be easily varied by adjusting the size of the inlet through which the outside air must enter. The rest of the air to be heated is drawn from the floors of the heated rooms. The owner, with a system of this kind, is thus free to secure the quality of ventilation he desires up to a certain point. Of course, the cost of operation rises rapidly as the quality of ventilation increases, as it requires much more fuel to heat a cubic foot of outside air up to the temperature required than to heat a cubic foot of air from the floor of the room when the room is kept at ordinary temperature.

The main disadvantages of the hot air furnace are: (1) the difficulty of heating the windward side of the house; (2) the contamination of the air supply by the fuel gases leaking through the joints in the furnace; (3) the cost of operation when outside air is circulated.

There can be no doubt that the natural draft from the hot air furnace is very weak and any difference in pressure will tend to force the air along the line of least resistance. If, however, this system is well designed, and both a heat flue and a vent flue are supplied in each room, the trouble is not so serious as with the usual system installed, in which the vents are only taken from one or two rooms. The contamination of the air supply, by the fuel gases leaking through the joints, can be avoided by proper construction of the furnace, and by keeping it in good repair.

In connection with the inlet and vent pipes, probably one of the worst troubles is that due to dust and dirt accumulating in the flues and being later blown out into the room by the velocity of the air. The flue gases in many cases do sooner or later get into the rooms, due to leaky joints which are not usually repaired.

The cost of operation, as before stated, depends largely on the amount of fresh air entering the furnace. If the outside air is entirely closed off, there should be no great variation between the cost of operation of the hot air system and that of any other system. The hot air furnace consists essentially of two shells, one inside the other, the fire being placed in the inner shell, and the air to be heated circulating in the outer shell. In the case of some of the larger furnaces, however, the outer casing is omitted, and the furnace is enclosed by walls usually of brick, and the air to be heated passes through this chamber. In order to get over the dryness of the air when heated to a high temperature, furnaces are usually supplied with water pans which keep the air saturated.

In the case of large furnaces where ducts are long and nearly horizontal, a fan is sometimes used to force the air along the ducts, the fan being located between the fresh air inlet and the furnaces, so as to keep a slight pressure on the furnace and thus prevent the escape of the fuel gases as much as possible.

The other method of heating residences is by the use of hot water which is circulated by radiators, and there can be no doubt that, for the better and larger residences, this is the most popular system. The main advantages with the hot water system are that it does away with openings in walls or floors, which are dust collectors and to a certain extent unsightly; also that the circulation of hot water is independent of air currents, and it is just as easy to get the hot water to flow to one part of the house as another. The hot water radiators also are usually placed under the windows where they are most effective.

Hot water also retains its heat, and, therefore, it is easier to keep a house at an even temperature than with hot air. Also the hot water system is free from the leakage of fuel gases into the different parts of the house, as sometimes happens with the hot air system. There are a number of other advantages of the hot water system in residence work, but it is believed that these are the main ones. Its great disadvantage, of course, is that there is no ventilation of the rooms, and this must be effected by opening windows and doors, causing drafts.

Heating School and Other Public Buildings

We come next to the class of buildings such as schools and other buildings where a large number of people are congregated into a comparatively small space. In these buildings the question of ventilation is an important one. Such buildings were at one time heated by hot air furnaces, but their use has been practically discontinued and the usual practice now is to use a certain amount of radiation in each room, and also to supply a certain amount of air to each room, the air being heated usually slightly higher than the temperature of the room. The direct radiation, which is usually steam in the larger buildings and hot water in the smaller ones, supplies the main part of the heat; the air, which is taken from outside and heated, usually by passing over steam or hot water coils, and then forced into the room by means of a fan, supplies the ventilation. The main reason for use of the two systems is that the ventilation is only required while the rooms are occupied, and as soon as the occupants are out of the rooms, the fan is shut down.

Unless some heat were supplied of course the rooms would then rapidly cool off, and it is partly to provide against this that direct radiation is installed. It can be readily seen, of course, that it costs considerable to operate the ventilating apparatus, as the cold air is drawn in from outside, heated, blown into the room, and exhausted at the room temperature, which means that a great deal of the heat in the air is wasted. When it is remembered, that in buildings of this class, the air is usually changed about six times per hour, the cost of operation is readily understood.

With a system of this kind, the amount of direct radiation required is, of course, less than if the ventilating system were not used, as the hot air coming in at a slightly higher temperature than the room, and also being forced in under a slight pressure, prevents the cold air from leaking in as the air in the room is under a slight pressure.

The use of both a heating and ventilating system, of course, costs considerably more to install and operate than if the building were heated by either system by itself. Occasionally buildings are heated by forced hot air altogether, but as stated before this usually results in considerable waste of fuel, as the air is taken from outside. If the air instead of being taken from outside, is re-circulated in the building, it is still necessary to run the fan, which not only takes considerable power but requires a regular attendant on the job all of the time. If the fan is shut down over night in such a system, the rooms get chilled before morning, and it takes some time to get them warm again.

Warehouses and Office Buildings

Coming to those buildings which are heated and not ventilated, we have such buildings as warehouses, office buildings, etc. A great many buildings, of course, which have no ventilation should have it, but it is omitted on account of the cost. There is no doubt that every building, where the number of occupants is large compared with floor space, should be ventilated. There are, however, a number of buildings such as warehouses, storages, etc., where the results would not warrant the additional cost. These buildings are usually heated by either steam or hot water. Gravity hot water system is of course limited to smaller buildings, as the force circulating the water is not sufficient to guarantee circulation in a building where the friction losses are great or the runs long. In such cases forced hot water is used, that is, the hot water is forced through the building by means of pumps. The main advantages of this system are: (1) economy of operation, due to fact that water may be circulated at any temperature or any speed, thus giving the man in the engine room practically control of the heating. This may be readily seen from the fact that steam must be 212 deg. F. or more so that on a mild day the rooms are too warm, and the occupants must open and close the radiators. With the hot water system the temperature of the water may be varied to suit the outside temperature.

Other advantages of hot water over steam are; mains may be run to suit contour of building, no drips being necessary as with steam; large storage capacity, which means ease in keeping uniform temperature. Where steam is used it may be either circulated under slight prssure or by some vacuum system. The question of deciding between steam and forced hot water heating, depends largely on the use to which the building is to be put. Where there are groups of buildings to be heated by a control plant, there is no doubt that the forced hot water system is the most popular, and most efficient, and the simplest since its economy of operation is not dependent on the adjustment of delicate parts, such as thermostats, and the same temperature is maintained year after year. The main limitation to the use of forced hot water is the height of the building and where this height exceeds one hundred feet, the pressure becomes so great on the radiators and connections that there is liable to be considerable leakage.

Foundries and Machine Shops

The other class of buildings are those with high ceilings and large window areas, such as, foundries, machine shops, etc., and these buildings are usually heated by the forced blast apparatus, although pipe coils are sometimes used. For such buildings the cost of installation is probably not much different, but the cost of operation of the fan blast system is usually slightly less than with direct radiation. There are, however, other advantages which point to the fan system as the best one for this work.

In buildings of this kind, there is difficulty on account of the heated air rising to the roof, and passing out through the ventilators. This acts like a chimney, and draws in cold air through every opening around the windows and doors at the floor level, causing bad drafts, and also wasting a great deal of heat. The fan system, by delivering air at a slight pressure, does away with this leakage, as the pressure in the building is slightly higher than that outside.

Then, if direct radiation is to be used it is difficult to get a suitable place to locate the coils except around the outside walls, but with the fan system the pipes are usually run overhead, and openings can be left at suitable places, and the air is forced through and so can be more evenly distributed. Also with direct radiation on account of the coils being close to the walls a good deal of the heat is radiated through the walls without affecting the temperature of the building, while the fan system heats the air itself. Fan systems also heat the air up much more rapidly in the morning, as if the cold air inlets are closed the fan rotates the air of the shop through the coils heating it up slightly every time it passes through. It is comparatively easy, with the fan system, to remove smoke, steam and dust, through the monitor. A fan system should have its inlet so arranged that it can draw its air either entirely or partly from outside or from the shop.

Another disadvantage of the pipe coils is that they are liable to be broken or damaged, and there is also a long run of pipe around the building which must be kept in repair. The fan system having one central location, and merely air pipes running around the shop, is free from trouble of this kind.

The usual method is to run the hot air pipes about fifteen or twenty feet above the floor, but, sometimes, the air ducts are run underground, and in some cases the air is carried up in the posts of the building, which are made hollow for this purpose. The usual apparatus consists of a power driven fan which draws the air through steam heated coils, and forces it through ducts to different parts of the building. Sometimes the air is only partly heated before entering the fan which blows it into a chamber, and from here the air passes through heating coils at the bottom ducts, where it is finally heated and passed into the room.

Some Points Concerning Our Present Knowledge of Paints for Structural Steel and Recent Improvements Made in Paints

THERE are a number of paints on the market which are claimed to be efficient in preventing the corrosion of structural steel. Although the subject of paint making has for years been given great attention by experts, and notwithstanding the progress made in recent years, there is still considerable room for improvement. As all engineers realize the importance of securing a paint which will prevent corrosion, any discussion looking toward a solution of this problem will prove of interest. The following article, which has been taken from a paper, "Painting Structural Steel: The Present Situation," by A. H. Sabin, in Vol. XXXIX, Proceedings, Am. Soc. C. E., p. 2061, discusses paints for structural steel and gives the present status of paint making:

Attempts to Classify Pigments

Much has been written and much has been done relative to the protection of steel; but improvement has been slow, progress being made step by step. Some years ago, Mr. G. W. Thompson attempted to classify pigments, as to their relation with iron, by suspending them in water and immersing pieces of iron or steel in these mixtures. The results were somewhat surprising; some of the pigments seemed to increase corrosion in this condition, and others, known to be useless in protective paints, seemed to be much better for preventing it. Lampblack, for instance, was the worst in provoking corrosion, and white zinc or pulverized chalk prevented it. This was probably due to the fact that lampblack contains, condensed on the surface of its particles, considerable carbonic acid, which is the most generally active agent in the corrosion of iron, while white zinc and chalk are basic substances by which iron is not rusted; however, the carbonic acid in lampblack is displaced by grinding in oil, and the well-known lack of durability in paints made of white zinc and chalk prevents their good qualities from coming into action.

So great is the need of more knowledge as to the value of pigments in paints, and their mode of action, that nothing which promises new information is neglected. A committee of five chemists from different parts of the United States, with the approval of the Society for Testing Materials, made a series of tests of the principal pigments, and of some other substances, on steel immersed in water; and, as was to be expected, arrived at substantially concordant results. These results, as has been stated, were of no value from the standpoint of the paint-maker, being inconsistent with the known value of the pigments when ground in oil or varnish. When the report was published, however, the pigments were classified, according to their water value, into three groups, namely, inhibitors, indeterminates, and stimulators. This was the origin of the use of these now well-known words in paint terminology. It was expressly stated in the report that this was a classification as regards water only; but the names were so convenient and so tempting that those not familiar with the subject, and also many who saw their value for advertising purposes (two quite distinct classes), put them into common use to classify pigments in oil. It is obvious that any classification of pigments in oil should be based on their behavior in oil, and if, as must be conceded, this is radically different from water tests, the latter should not be regarded. All this investigation began some years ago; meanwhile, numerous young men, mostly students working under the supervision of their teachers, have made brief and generally inconclusive studies of paints, and almost without exception have used these indefinite terms, inhibitors and stimulators. Patents have even been taken out—which, in the writer's opinion, are not only worthless but invalid—covering the use of old and well-known pigments. What is worse, every maker of a paint nostrum assures his hearers or readers that his particular paint absolutely inhibits rust, and that everything else stimulates it. This is the whole history of this jargon about inhibition and stimulation; it never had any particular value to the consumer, and it is generally used to mislead him.

Composition and Durability

It is obvious that in a good paint the pigment particles are enveloped in a film of oil; they do not come in contact with the iron; if they did, the paint would peel off, for no dry pigment adheres well to metal. Steel rusts because air and moisture act on it; and paints are used to keep air and moisture from it. They do not inhibit rusting, except as they inhibit the cause of it.

The important practical question is whether paints have been or can be improved as to being non-porous and durable. This is essentially dependent on the relation between the pigment and the oil. As to the true nature of this relation, very little is known; but something is known about its visible manifestations. It is known, for instance, that 1 lb. of dry red lead mixed with ¼ lb. of oil makes a paint of ordinary consistency, and 1 lb. of dry lampblack requires at least 6 or 8 lbs. of oil, say, thirty times as much, or making allowance for difference in density, six times as much as the red lead. Similarly, 1 lb. of white zinc takes twice as much oil to make a paint as 1 lb. of white lead; and white lead takes nearly twice as much as red lead. These are things we know; but we have no idea why they are so. Again, red lead, which is an oxide of lead, makes an excellent paint for iron; oxide of iron is neither very good nor very bad; oxide of manganese is bad. Our knowledge of paint is as yet largely empirical. Where we are gaining is in more general appreciation of the value of the proper application of paint, better preparation of surface, more confidence in good paint rightly used, and in the better preparation of paint materials. For instance, in the older books, and until about twenty years ago, we find analyses of red lead showing as low as 55 per cent. of true red lead, with 45 per cent. of litharge. Red lead is made from litharge, and the presence of the latter is not a sign of adulteration, but of incomplete conversion. At the same time other samples showed as high as 80 per cent. of true red lead. As is well known, there was much difference of opinion in those days as to the value of red lead as a paint for iron; though most users liked it, some thought it poor stuff. It is now known that its value depends on the quantity of red lead it contains. Coarse red lead always contains litharge, because the litharge in the middle of a large particle is never oxidized. It was observed that the finer the red lead, the better it was, and so a demand arose which forced the manufacturers to make higher grades; now they are grinding their litharge to an impalpable powder before roasting it, with the result that 94 per cent. of true red lead has been on the market for some years. Then an unexpected fact was developed. The old red lead when mixed with oil would set in a day or so—often in a few hours—into a cement, just like plaster of Paris and water; this tendency made it work with difficulty and unevenly in application, and its coarseness gave it a tendency to run; but the new, or high grade, article is inactive to oil, and brushes out smoothly like a house paint. This enables the painter to cover 50 per cent. more surface with the same quantity and still get a coating having a uniform thickness which gives more protection than the thin portions of the paint formerly used. This secures greater economy, even at a slightly greater cost per gallon; and this is an economy not only in the cost of the paint, but in the labor, because the paint works more easily, and a man can cover more surface in a day; it also requires less skill, and therefore a less highly paid man, to do good work. For the last year or two, red lead ground in pure linseed oil has been offered to the trade as a paste ready to be thinned with more oil; such a paste keeps for a year or more, or indefinitely as far as known, like white lead paste. Its use saves time and waste in mixing, and, being ground through a mill, the mixture is perfect, which is not the case with hand-mixing; and, as it avoids the presence of a dusty pigment, it is more sanitary.

The only serious objection to the use of such red lead is that it dries more slowly than the older kinds. This can be obviated, however, by the use of a little japan drier. There is a well-founded prejudice against the use of excessive quantities of drier in any paint; but it should be remembered that red lead paint mixed in the (standard) proportion of 28 lbs. of pigment to 1 gal. of oil, contains 20¼ lbs. of pigment per gallon of mixed paint. If this pigment contains 15 per cent. of litharge, it has 3 lbs. of litharge per gallon. Now, ordinary, good, lead japan driers, or lead and manganese driers of approved quality, contain the equivalent of 1 lb. of litharge in about 3 gals. of drier; and 3 lbs. of litharge will make 8 or 10 gals. of drier. To make 1 gal. of mixed 94 per cent. red lead paint dry requires only one pint of drier; the rest is excess. It is much safer to add the desired quantity of drier. It may be asked why the litharge in the 94 per cent. red lead is not more active; it is probably because, when the peroxidation of the lead has been carried so nearly to completion, the particles of litharge are enveloped so completely by a dense coating of true red lead that the oil does not reach them. This is obviously not the case with the commoner and less thoroughly oxidized pigment.

It has sometimes been suggested, by those not very familiar with the chemical questions involved, that the litharge is the essentially valuable part of the paint, and that the red lead is only an inert extender. This is not so. The whole history of the subject shows that the improvement in red lead for paint during the last twenty-five years has been made by reducing the litharge contained in it; litharge alone, or used with other pigments, has not been satisfactory, though orange mineral, which is red lead free from litharge, is most excellent, and would be used if its cost were not so great. Further progress will undoubtedly produce red lead with a lower percentage of the protoxide; in fact, the 94 per cent. red lead now in the market usually contains much more than 94 per cent. of true red lead.

Progress Made

Progress has also been made in our knowledge of linseed oil. Within a few months, the American Society for Testing Materials has adopted specifications for North American raw linseed oil, which is of better quality than that made from South American seed. These specifications are the result of a great deal of work by many of the best oil chemists, and it is now possible for any good analyst to tell whether or not an oil is pure and good. Methods of paint analysis are in general being standardized; and a vast amount of work is going on in Germany and England as well as in the United States, on the chemistry and nature of drying oils. At present linseed oil has adulterants, but no substitute; China wood oil is a valuable drying oil, more valuable for some purposes than any other, but, as an oil for ordinary paints, it is used, as far as the writer knows, only to cover up the use of non-drying oils which must be regarded as adulterants. At present prices, it is not likely to be used even in this way. Fish oil is used to some extent, as it always has been, in paint for roofs and smokestacks; but one should not be disturbed by talk about the "newer paint oils," for, except China wood oil, there are none.

In closing, it may be well to mention that the committee appointed by the American Society for Testing Materials has made a final report on the condition of the paints on the Havre de Grace Bridge. As is well known, this bridge was painted six years ago by a committee of that society, which committee included several members of the American Society of Civil Engineers. This report describes three of the paints as excellent; two of these were straight red lead in oil, and the third was red lead, with about 15 per cent. of a pulverized silicate added, in oil, the red lead being about 98 per cent. true red lead. Nine other paints, of varying composition, are reported as affording generally effective protection to the structure. As all these paints were carefully applied, it is fair to conclude that the durability of any good paint may be increased one-half, and probably doubled, by proper care in its use as compared with average practice. It is only by continually reiterating this fact that we shall ever secure the most elementary and fundamental requirement for the economical treatment of structural steel—Engineering and Contracting.

According to Prof. A. V. Bleininger, who was heard at the Brantford, Ont., convention of clay-workers a few years ago, clays which are difficult to dry because of their high shrinkage may be rendered normal by heating the raw clay, as it comes from the pit, in a rotary furnace at a temperature of 250 to 400 degrees C. This destroys part of the plasticity-forming power of the clay, and enables the material to be dried in the same manner as less plastic clays. The cost is very slight. The addition of sand, burned clay, or other non-plastic material also will convert many tender clays into those of normal strength. It does this by separating the particles and increasing the pore spaces. Mixing clays with boiling water instead of cold during the pugging or tempering has a similar effect, and, in addition causes the brick to harden slightly as they cool before entering the dryer.

Constructional Activities at Calgary

Many Large Structures Nearing Completion and Excellent Prospects for 1914—Foundry Plant at East Calgary

THE end of the year finds many new industrial projects well toward realization in this city. Although Calgary has been regarded more in the light of a wholesale centre and grain distributing point, the advent of the Grand Trunk Pacific and the Canadian Northern seem to be giving this city an impetus towards the establishment of industries. There are well defined reports and a little evidence that at least two other railroads will enter Calgary shortly. The discovery of oil in even limited quantities south and in a territory tributary to the municipality cannot but accelerate the movement towards a great industrial city. The C. P. R. are even now applying to the Dominion Parliament for permission to build a branch into the oil district.

The growth of the city is attended by the construction of many interesting engineering structures in and about it. The building permits to the end of November have maintained a healthy tone. The total permits for the first eleven months of the present year amount to $8,283,153, a decrease of 47 per cent. from the preceeding year, and a decrease of 26 per cent. from the year 1911. A large amount of new work is in view for next year and a very optimistic tone prevails among the local contractors. As described below, one local citizen is preparing to expend over half a million dollars in building construction and there are besides numerous other projects, not so large, to go ahead next year. It is anticipated that a great amount of public building will be done in 1914, including the new million dollar Post Office, new buildings for the Exhibition Company, an Industrial Building for the City of Calgary, a subway at Fourth Street West, the new barracks for the Royal North West Mounted Police, and stations for the C. N. R. and G. T. P. Railways, besides at least one, or perhaps two, flour mills.

The Exhibition Company contemplate a complete re-arrangement of their grounds in Victoria Park and the construction of a new race track with reinforced concrete grand stand, new administration building, new manufacturers exhibition building, horse and cattle barns, besides a large amount for water and sewer connections, roads and sidewalks and ornamental lighting.

The City of Calgary has practically arranged with the Robin Hood Mills for all damages in connection with the construction of a subway at Fourth Street West. This will give the city five subways across the main line of the Canadian Pacific Railway in a range of ten blocks. The estimated cost of this subway, with damages, will amount to about $500,000. The by-law providing for the erection of a building for housing small industries has been passed by the ratepayers and plans are being prepared for a structure to cost $150,000. The architect is Mr. Alex. Pirie, of Calgary, with whom is associated the firm of Lawson & Fordyce, of Calgary.

A power sub-station has just been completed in the northern part of the city, and it is probable that one and perhaps two additional ones will be erected next year at a cost of $25,000 each. As noticed in the last letter, the Calgary Flour Mills, Limited, are preparing for the construction of a flour mill which will have an ultimate capacity of 6,000 barrels per day. A site aggregating 15¼ acres has been purchased in East Calgary at the junction of the Calgary & Edmonton Railway, with the Grand Trunk Pacific. Borings are now being made with a view to ascertaining the condition of the ground for a foundation, and it is intended that the contract for the first unit, together with storage bins, shall be let in the early spring.

Mr. Thomas Mawson, the noted town planner retained by the municipality, has submitted his preliminary schemes for the beautification of Calgary, including in this scheme the construction of one or more bridges across the Bow River and the replacing of existing steel structures to accommodate the present traffic as well as that which will be diverted to them by the traffic routes contemplated in the new scheme. This will reopen the controversy as to the relative merits of a high level or a low level bridge to serve the north part of the city at Centre Street.

The mild weather prevalent has enabled the contractors to make rapid progress on all large buildings. The contractors for the new Police Headquarters building for the City of Calgary have completed the reinforced concrete structure and have the building enclosed, excepting for one storey. The steel prison cells and electric elevators for this building will be ordered through the City Stores, early in January. Lang & Major, of Calgary, are the architects; Thomas, Jamieson & McKenzie, are the contractors. The tenants are commencing to enter the new building of the Herald Publishing Company. This is the tallest office structure in this Province, being ten storeys high and built of reinforced concrete, with brick and terra cotta exterior. The architects are Brown & Vallance, of Montreal. Messrs. Rutty & Weare have completed the erection of a magnificent residence for Eugene Coste, President of the Canadian Western Natural Gas, Heat, Light and Power Company, Limited, of Calgary, at a cost including grounds, of $160,000. Hayden & Skeene, Limited, of Vancouver and Calgary, have commenced the construction of the main diversion weir for the Western Section of the C. P. R. Irrigation project in East Calgary. This will necessitate a coffer dam of wooden and steel sheet piling, after which a canvas cover will be erected which will enable the contractors to place the concrete during the cold weather.

The Calgary Builders' Exchange is arranging a series of lectures during the winter months for the benefit of its members. The first of these was given by Mr. L. M. Gotch, A.R.I.B.A., on "Town Planning," November 26th last. The local branch of the Canadian Society of Civil Engineers held its first annual meeting December 6th last and the following officers were elected for the coming year:—Chairman, H. B. Muckleston; secretary-treasurer, P. M. Sander; executive, S. H. Peters, A. S. Dawson and Geo. Romanes. An arrangement has been made for the use of the rooms of the local Chapter of the Alberta Association of Architects, 115 Judge Travis Building.

A new firm for builders' supplies and contractors' equipment, the Marshall-Izlar Supply Company, with offices in the Maclean Block, have commenced business during the past month. Mr. Marshall, the senior member of the firm, is well known in this city through his connection with the Calgary Herald. Mr. Izlar has had much experience in the California oil fields.

The Calgary Power Company are about ready to put their new units into commission, giving them a total capacity of 30,000 horse-power at the plant. The Calgary Water Power Company, Limited, operating a hydro-electric plant on the Bow River in Calgary, have announced their intention to expend $300,000 to instal two gas-driven electric generator units and two water-wheels having each a capacity of 1500 kw. This plant operates from the lumber sluice of the Eau Claire Lumber Company, under a sixteen-foot head, and was the first to supply electric light and power in this city.

Carter, Halls, Aldinger & Company, Limited, of Winnipeg, have completed the construction of a new five-storey warehouse for the Canadian General Electric Company, Limited, and their subsidiary company, the Canadian Allis-Chalmers Company, Limited. The building is on trackage on 10th Avenue West and has a frontage of 50 feet. The construction is pressed brick exterior, with cut stone trimmings; with interior of mill construction. The structure will be the head office for this province, and is the result largely of the business capacity of Mr. A. P. Horner, who has been the local manager for these companies since their establishment in this city. The cost was about $150,000. The architects were Hodgson, Bates & Beattie, of Calgary.

The Allan Theatre

One of the more noteworthy structures completed recently is the Allan Theatre, a magnificent building on 8th Avenue, in the heart of the business district, to be devoted to exhibiting the films of the Canadian Film Company, Limited. The entire project has been carried out by local capitalists, who have made an expenditure of $100,000 for the building and site. The theatre was opened to the public November 14th last, and represents the most advanced ideas in the equipment of motion picture theatres. The structure occupies an inside lot with a frontage of 46 feet, has an extreme depth of 130 feet and is of fireproof construction throughout. The exterior of the building is of marble and ornamental plaster, with metal trimmings; the interior has been richly decorated in marble and onyx, with vaulted ornamental plastered ceilings. Entering the vestibule, there is the ticket window, with a small shop on one side and a shoe-shine parlor on the other, thence one passes into the lobby—off which are the office and the ladies rest room and toilet—and enters the foyer. From the foyer, access is had by marble stairways on either side to the balcony and to the main auditorium, 45 feet wide, 65 feet deep and 34 feet high. The balcony is 45 feet deep, in the centre of which is the operator's cage. The picture screen is 13 ft. 6 in. high, and is 18 feet long, with a curved surface to conform to the curvature of the lenses used in the motion picture machines. There is no stage, but on the left of the screen there is a singers' balcony, while on the right is a fine pipe organ, supplied by Kimball & Company, of Chicago, at a cost of $15,000. The keyboard is located in the orchestra pit. From the balcony there are four fire exits, two to the rear exits and two to the street, the latter leading to balconies, from which ladders reach the street.

A very complete heating and ventilating system has been provided. Warm air heating has been installed, with air-washers, forced draft mechanical ventilation, including blower and exhaust fans. The boiler installed has a capacity of 100 h.p., Alberta rating, and the entire system is capable of maintaining a constant temperature of 70 deg. F., and has a capacity of 160,000 cu. ft. per three minutes. E. J. Young Plumbing Company, Limited, of Calgary, were the contractors for the plumbing and heating and ventilating. The building was constructed by day labor and sub-contracts by the owners, under the supervision of H. L. Gage, work commencing about May 1st. In the beginning, it was necessary to shore up both the adjoining party walls, built of rubble stone, and this alone involved considerable care. The construction throughout is of reinforced concrete, the Kahn Floredome system being used. A total of 650 yds. of concrete and 68 tons of steel were used. All partitions are terra cotta tile, manufactured by the Alberta Clay Products Company, Limited, of Medicine Hat. For mixing the concrete, a 5 cubic foot cubic mixer was used, the concrete being hoisted to the required elevation and deposited in the forms from Ransome carts. The hoisting bucket and hopper were built on the job. The cost of the building was about $75,000, the architect being James C. Teague, of Calgary.

Big Foundry Plant

Westinghouse, Church, Kerr Company, Limited, have completed the construction and equipment of the plant in East Calgary for the North Western Brass Foundry Company, Limited, representing an outlay of $250,000. The main building measures 200 feet in length by 100 feet wide, and there are installed twenty furnaces, with ovens, sand bins, pattern rooms, as well as finishing, assemblying and shipping rooms. Twenty-three metal bins, having a capacity of 20 tons each, provide storage for continuous operation. The plant is alongside the main line tracks of the Canadian Pacific Railway, and is served by a spur capable of storing twenty cars alongside the building, for unloading the necessary coke and moulding sand. At the north end of the building is the garage for the company's motor trucks, 40 feet by 70 feet. The construction throughout is reinforced concrete, with a maximum of steel sash on all sides. In general, there is a crane runway 29 feet high, 27 feet wide, running the length of the main building, with wings on both sides 16 feet high in the clear. Columns are spaced 25 feet on centre longitudinally. The roof slabs are 4 inches thick, carried on beams running the length of the building, 6 ft. 3 in. on centres, these beams in turn being carried by girders spanning the 27 feet clear of the runway. The main girders are 10 in. wide by 25 in. deep, carried on 18 in. square columns. The roof slab is covered by a 5-ply tar and gravel roof. The entire plant is steam heated, and the glazed wall areas give the best lighting possible. The plant was designed by the A. E. Baxter Engineering & Appraisal Company, of Buffalo.

Dr. N. J. Lindsay, of Calgary, has under way three buildings, aggregating in cost nearly $600,000. Fyshe, McNeil, Martin & Trainer, of Calgary, have completed the construction of a fine motion picture theatre which combines several unique features. The building is of stone, brick, and reinforced concrete construction, and occupies a plot 50 ft. by 120 ft. in the middle of a block, opposite the large department store of Pryce-Jones, Limited. The auditorium has a maximum seating capacity of 550, with a stage 5 ft. deep and proscenium opening 14 ft. by 17 ft. The main floor is a patented mastic flooring, and can be flushed at will by water discharged from perforated pipes running along the bottom of the seats. A forced draft ventilating system will change the air every 15 minutes. The building is steam heated; has indirect electric lighting; and an intercommunicating telephone system adds to the convenience of the playhouse. The total cost has been about $40,000. In addition to this building, Dr. Lindsay has under construction in this city a fine residence, estimated to cost some $30,000. The exterior in Tudor Gothic, is cut stone and light brown tapestry brick, with interior walls of brick. It has steel floor beams and reinforced concrete floors. The building occupies a site on the slope of a hill and has a full basement, two living floors and an attic. There will be a large ballroom, billiard room, 7 bedrooms—each with private bath—besides dining room and service.

The excavation has been completed for the construction of what will ultimately be a ten-storey office building, on the corner of Centre Street and 7th Avenue, where the Knox Presbyterian Church stood. It is the intention now to build but six storeys, but the structure will be designed for four additional ones. The building will be 130 feet by 150 feet in plan, and will have a fireproofed structural steel frame, with reinforced concrete floors. The exterior will be ornamental terra cotta on the street sides, with hollow brick walls on the alleys. Four wells have already been driven on the property, to furnish water for tenants, boilers, and for a high pressure fire service. The owner will install his own electric light plant. Two high speed traction elevators will be installed, with provision to add a third when the height is increased. The building will be fitted up for stores on the ground floor, with offices above. The first cost will be about $500,000. The architects are Hubbell & Kelly, formerly of Seattle, now of Calgary.

Ceramics, Limited, of Calgary, formerly the Sandstone Brick & Sewer Pipe Company, Limited, have in course of erection a large plant at Sandstone, south from Calgary, for the manufacture of vitrified clay products, especially sewer pipe. At present, practically all the sewer pipe used in the Canadian West are imported from Ohio, pay a duty of 35 per cent., and a freight rate to Calgary of about 75 cents per 100 pounds. As the City of Calgary alone lays mile upon mile of vitrified sewer pipe every year, a market is already awaiting the product of such a plant. The company owns a tract of 220 acres of one of the most diversified shales in the Dominion—one of two known deposits in Canada—in fact, from which the manufacture of glazed terra cotta for architectural purposes can be manufactured. Tests have been made, and full size pipes manufactured, and the shales have been pronounced second to none for the use to which it is intended to work the deposits. A well already driven on the property will supply natural gas for power and fuel. The president of the company is Mr. John Steinbrecker, of Calgary. R. A. Brocklebank, president of the local Builders' Exchange, is a vice-president and director.

The tracklaying gang and the bridge builders of the Canadian Northern Railway are now within the city limits and the construction of freight sheds and a temporary passenger station is being rushed by the contractors, Carter-Halls-Aldinger & Company, Limited, of Winnipeg. Grading has also been commenced on the Calgary-McLeod Branch. In East Calgary, the tracks of the C. N. R. cross over the main Western Canal of the C. P. R. Irrigation System, the main line of the C. P. R., and the road and street railway to Ogden and the C. P. R. Shops, then over the Bow River, the McLeod Trail, by subway over 2nd Street East, and then over the Elbow River into the heart of the city. The first bridge, that over the C. P. R. and street railway, comprises a total of seven plate girder spans of varying lengths, with latter a 300-foot truss span over the canal. The longest of these spans is 72 ft. 6 in., the girder being 8 ft. 4½ in. deep at the centre, and 5 ft. 6 in. at the supports and spans the street railway. The girder over the three tracks of the C. P. R. has a span of 65 ft. and is 8 ft. deep. All the intermediate supports are Bethlehem H-columns. The Bow River crossing has six deck plate girder spans of equal length, and is 540 ft. long. The girders are 89 ft. 8 in. long, and 9 ft. 7 in. deep; the web plate is 115 in. by ⅜ in.; the top flange is built up of 2 angles 8 x 8 x 5-16, and two angles 8 x 6 x ⅝; the bottom flange of 2 angles 8 x 8 x 11-16, 2 cover plates 8 x ½. The girders are 8 ft. on centres, and weigh about 23 tons each, and were fabricated by the Canadian Bridge Company, Limited, of Walkerville. The erection is being done with two 35-ton, 3 drum, Lidgerwood bridge cranes, with boom 56 ft. long, a single timber 16 in. square. In the course of erection of the first span, a spliced boom broke at the boom-seat, dropping the 23-ton girder to the river bottom, 30 ft. below, one end resting on the embankment. Although slightly bent at one end, where the abutment was struck, the girder was not even badly strained, and is doing duty as intended. The contractors for the erection are Frankman Bros., of Winnipeg; the inspection is being done by the Canadian Inspection and Testing Laboratories, Limited, of Montreal, for whom Mr. J. Ormond Riddell is the local representative. As soon as the tracklaying reaches the McLeod Trail, the crossing there will be erected; a through plate girder span of 81 ft., with one approach span of 13 ft., and another of 25 ft., both deck spans. The steel for this crossing, and the C. P. R. crossing detailed above, was fabricated by the Manitoba Bridge & Iron Works, of Winnipeg.

Another ten-storey structure is to be erected in Montreal. This is the Marcil Trust Building, the site of which is on the south side of St. James Street. The plans are by Messrs. E. and W. S. Maxwell, Montreal. It is estimated that the entire cost will be about a million dollars. The building will be of reinforced concrete, with an exterior of terra cotta. A marble staircase will lead to the safety deposit vaults of the company, which are to be of the most modern burglar proof equipment. In connection with the safety deposit vault departments there will be a luxurious furnished waiting room. The corridors throughout are to be of Tennessee marble. Three electric elevators will be installed.

An unusual phenomenon was reported on November 7th by a Canadian Pacific Railway train "dispatcher." The work of dispatching is done by a telephone, and while listening at his instrument, the "dispatcher" picked up regular dashes and dots of the Morse code, and as he was an expert telegraphist he could follow the message, which was a wireless communication from some vessel at sea announcing her approaching arrival at San Francisco. Apparently the telephone wires had acted as an aeiral. The name of the ship is not known, as only her code number was signalled.

Completion of the Jordan River Dam

Noteworthy Structure of the Vancouver Island Power Company—Hollow Reinforced Concrete Type, 125 Feet High and 890 Feet Long

THE Vancouver Island Power Company, Limited, a subsidiary concern of the British Columbia Electric Railway Company, Limited, have placed themselves in a position to become one of the most important producers of electrical energy in the Dominion by the completion of the great dam at Jordan River, a work which was undertaken to meet the increased demand from the city of Victoria and environs upon the company's hydro-electric plant there. In addition to the constantly growing industrial demand for light and power in the Saanich peninsula, as increased storage capacity has also been found necessary for the purpose of keeping pace with the extensive development of the tramway system of the B. C. Electric Railway consequent upon the remarkable growth of Victoria and the districts adjoining.

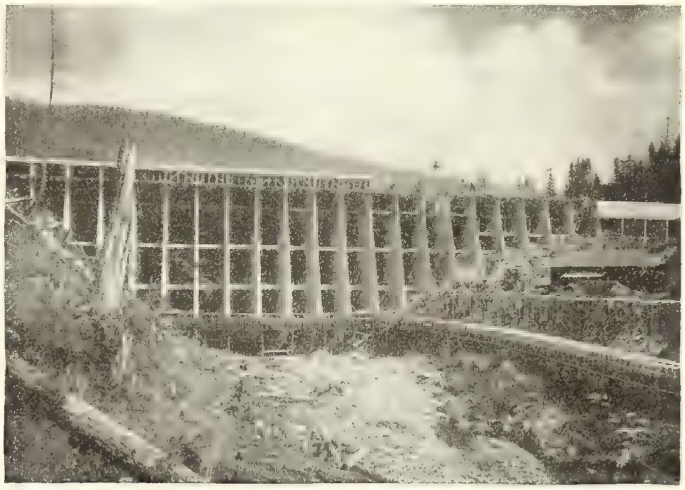
The Jordan River plant is situated at the mouth of the Jordan River on the Strait of Juan de Fuca, about 43 miles from the city of Victoria, the plant at present in operation comprising two electrical units of 6000 h.p. capacity each. Energy is transmitted at 60,000 volts to Victoria and a tie line connects this plant with the auxiliary steam power plant of the Vancouver Island Power Company at Brentwood Bay.

On account of the increased load on the system the capacity of the Jordan River plant will be enlarged by the addition of one 13,000 h.p. unit, bringing the total capacity up to 25,000 h.p., and thus rendering necessary the construction of the Jordan River dam. Prior to the construction of the permanent dam the waters of the Jordan River were diverted by a temporary rock filled crib dam, located a short distance above the site of the permanent dam, into a flume 6 feet in width by 5 feet 9 inches deep, and 6 miles in length, built with a grade of 1 in 1,000. The water was delivered by the flume into the forebay reservoir, formed by the construction of two earth dams, whence it was conveyed through steel pipe lines to the Jordan River power house. Additional storage was secured by the construction of a hydraulic fill dam on Bear Creek. The waters of Wye Creek were also diverted into the main flume by means of a rock filled crib dam, and the steam known as Alligator Creek has been diverted in a similar manner.

The area of the Jordan River watershed is 67 square miles; the effective drainage area has been found to contain 55 square miles, while the elevation of the effective drainage area is all more than 1200 feet above sea level. The elevation of the watershed is from sea level to 3,000 feet above sea level.

Up-stream side Jordan River dam.

The contract for the building of the permanent dam was awarded the Puget Sound Bridge and Dredging Company at the beginning of August, 1912, and active construction work inaugurated immediately, the entire undertaking requiring just one year to complete. The work consisted of the erection of a hollow reinforced concrete dam of the Ambursen type, together with about seven hundred feet of wooden flume and a small reinforced concrete arch bridge for carrying the flume across the Jordan River. Various types of dams had to be considered, and as it was important to store the autumn rainfall of 1912, an early date for the completion of the work was essential. No sand being available in the vicinity, it became apparent that a dam containing a minimum quantity of material would be required and the Ambursen type of dam was therefore finally decided upon.



Down-stream side Jordan River dam, showing buttresses, etc.

The completed dam is about 125 feet high in the highest section and 890 feet long over all. Of this length there is 452 feet of bulkhead or non-overflow section, 306 feet of spillway and 135 feet of earth embankment with reinforced concrete core wall. The deck or upstream side of the dam is built on a slope of approximately 1 to 1 and the downstream face of the buttresses on a slope of 1 to 4. On top of the bulkhead section there is provided a walkway six feet wide, which is protected by suitable hand rails and connected at each end of the spillway by stairs with another walk which passes entirely through the dam. The spillway has an eight-foot freeboard and provides for a flood discharge of 25,000 cubic feet per second.

Water is drawn from the reservoir through two sets of Coldwell-Wilcox cast iron sluice gates, each set consisting of two 3 ft. 6 in. x 5 ft. 6 in. gates, either of the sets being capable of discharging sufficient water to supply the demand, except at extremely low water. The gates are all operated by roller-bearing, hand-power hoists set inside the dam, the stems passing through stuffing boxes in the deck. Guides for stop logs are provided for shutting off either set of gates if necessary, and the whole is protected by two sets of trash racks which are mounted on trucks and can be raised clear to the top of the dam if necessary, for cleaning. There is a suitable hand-power winch for raising the racks located on the top of the dam. Heavy concrete counterweights are provided to assist in raising the racks. The storage capacity created by the dam is approximately 615,000,000 cubic feet of water or sufficient to supply all the electric power at present used in Victoria for five months. With the additional supply of the Bear Creek and forebay reservoirs there is enough stored energy to provide Victoria's power needs for eight months.

The site chosen for the dam proved to be well adapted to the type of dam built and for the efficient location of most of the construction plant. The profile of the site is such that work could be prosecuted on any part of the structure except in the five bays in the river bed, irrespective of the flood conditions of the river. This fact proved of the utmost value during the winter months when the river was subject to sudden and destructive floods.

Solid bed rock was uncovered for the foundations of the entire structure without excessive excavation. This rock provided an ideal foundation, being extremely hard and free from seams and faults. The grain of the rock, and what seams there are, run in a direction parallel to the axis of the dam, thus reducing the possibility of a leakage of water to a minimum and making it easy to secure a satisfactory cut-off for the entire length of the dam. The site also provides an excellent location for the spillway. The waste water after passing over the dam will be discharged into a natural channel which will carry the water away from the dam rapidly and discharge it into the river at a point far enough from the dam to prevent the possibility of damage from cross wash or any scouring action. The greatest difficulty with the site was the impossibility of building a tight cofferdam on the loose gravel and boulders which formed the river bed.

Crest of Jordan River dam.

In general the equipment consisted of the following machinery: two stiff-leg derricks, one 50-ft. and one 60-ft.; boom, with hoisting engines and boilers and an assortment of one-yard wooden skips all used on excavation work on the east bank of the river; one steam-driven compressor operating two Rand drills in the quarry; four one-yard Koppel cars; two No. 2 Aurora jaw crushers; one rotary sand screen; two 24-in. x 30 ft. Superior sand rolls; one 1-yard Kohring mixer, and one half-yard cube mixer; three 1-yard centre-dump concrete buckets; two concrete distributing cars; one cableway of about 900 ft. span equipped with 2¼-in. standing line and specially designed carriage and operated by a two-drum hoisting engine; carpenter shop with circular saw and blacksmith shop with two forges, hand power drill press and bolt machine with capacity up to 1½-in. bolts; three centrifugal pumps (one 10-in., one 8-in. and one 5-in.). All machinery except derricks, cableway and compressor was driven by electric motors with power furnished from the company's plant at the mouth of the river, a seven-mile transmission line having been built for the purpose. Power was transmitted at 6600 volts and stepped down at the works to either 2200 or 220 volts as required. Sheds were provided for the storage of cement, having a capacity of about 75,000 sacks, in connection with which there was a testing laboratory equipped for making the usual tensile tests on cement.

Under the terms of an agreement with the city of Victoria the initial expenditure on the Jordan River power plant by the Vancouver Island Power Company amounted to $1,500,000. To this sum must now be added the cost of the dam, totalling $550,000, together with another expenditure of $450,000 to enlarge the existing generating plant. The work of erecting the dam was under the supervision of Chief Engineer Mr. G. R. G. Conway and Mr. G. M. Tripp, engineering superintendent of the company, and his assistants, Mr. C. A. Lee, resident engineer, and Mr. W. Faust, superintendent of construction. A complete inspection of the plant was recently made by Mr. Wm. Young, controller of water rights. Mr. E. Davis, engineer of the provincial water department, accompanied by Mr. G. R. G. Conway and Mr. Tripp. The work impressed the government officials as being carried on in the most thorough manner possible.

Work is also to commence without delay on the substructure of the Kettle Valley Railway bridge, which will span the Fraser River at Hope, and afford connection at that point with the main line of the C. P. R. This bridge will be 1,000 feet in length, and when completed will cost between $750,000 and $1,000,000. Armstrong Morrison & Company, of Vancouver, were the successful tenderers for the superstructure, the contract for the upper portion of the huge structure being held over until a later period.

Mr. James Findlay, general superintendent of the Dominion Bridge Works, of Montreal, accompanied by Mr. R. B. Common, chief accountant of the company, visited Vancouver a few weeks ago. Mr. Findlay has been inspecting the progress of the bridges being erected by his company for the Canadian Northern Pacific Railway at Lytton and Kamloops.

About five thousand men are at work on the sections of the Canadian Northern Railway between Port Mann and Kamloops. By next summer the various completed sections in British Columbia will all be linked up. At the present time the completion of a number of necessary bridges is delaying work somewhat.

The death took place on December 8 of Mr. Miles Macdonell, who was for sixty years a resident of Toronto. Mr. Macdonell was a builder, working mostly for the government throughout the province. He was born in St. Andrews, Ont.

We regret to announce the death of Mr. A. D. Harris, president and founder of the Ontario Sewer Pipe Company, which occurred in London, Eng., on December 12. The late Mr. Harris was 54 years of age.

Mr. George McPhillips, a pioneer surveyor of Western Canada, died recently at Winnipeg. Mr. McPhillips served for six years as chief surveyor of the Western lines of the Canadian Pacific Railway.

Glossary of Terms Used in Road Construction

(Concluded from last issue)

Soil.—A generic term applied to many kinds of earth, but generally used to designate the upper stratum of the ground.

Soluble.—Capable of being dissolved in water or other liquid.

Spawls.—Fragments of stone, generally the waste pieces after stone has been worked. Sometimes called "spalls" and sometimes "splints."

Spewing.—A term applied to the act of water or mud being forced through the surface of a carriageway, or to the rising up of the clay or other soft material through the surface.

Spewy.—A term applied to a wet, "soggy" road.

Spilite.—Coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Spinney.—A small wood or clump of trees.

Spit.—In digging this word is used to designate the depth of the spade-blade.

Splay.—To cut away at an oblique angle.

Splint.—A term sometimes used to denote a splinter, or small flaky piece of stone.

Spoil.—The surplus excavated material taken away from any excavation.

Spoil Bank.—The heap where the "spoil" is placed.

Sprag.—A steel or iron pin at the back of a vehicle to prevent its slipping backwards.

Spray.—To sprinkle in the form of very fine atomised particles or drops.

Spread.—To disperse or scatter over a large surface. The word is sometimes used as a noun to denote the area covered.

Sprinkle.—To scatter in drops or small particles.

Spud.—A small kind of spade for removing weeds.

Squeegee.—A tool with a rubber addition for scraping or cleansing hard paved surfaces, and also for distributing tar, etc., on surfaces.

Squeegee Coat.—A term sometimes applied to the final fine seal coat on a carriageway, which has been spread by means of squeegees.

Standard.—The post or pillar on which a lamp or electric wire is fixed.

Standpipe.—A vertical pipe or column fixed on a water main for street watering purposes.

Steening.—The liming of a well.

Stile.—From "stigel," a step; steps to mount a hedge or wall.

Stocking.—See "Chequering," "Hacking," or "Scarifying."

Stone-breaker.—A machine for breaking stones; also sometimes called a stone-crusher.

Stone-dryer.—An apparatus for drying stone before being treated with tar or with a bituminous mixture.

Storm Water.—A term used to designate the rain water falling on a road or flowing on to it. It has the same signification as "Surface Water."

Street.—A term generally applied to a road in a town to distinguish it from a road in the country or the suburbs.

Street-orderly.—A scavenger.

Street-sweeper.—A machine for sweeping carriageways.

Streetway.—The open space of a street.

Strength-crust.—A new term introduced to designate the intermediate layer or course of a carriageway between the bottoming or foundation and the upper crust or top layer.

Strengthening.—A term sometimes employed to denote much the same thing as "resurfacing."

Stretch.—Sometimes used to denote a certain length or "stretch" of a road.

Stretcher.—A brick or stone laid horizontally with its length in the direction of the face of the work.

Strewing.—Spreading by scattering. See also "Spread" or "Sprinkle."

Striated.—Marked with slender parallel lines.

Stringy Bark.—The name of a hard wood from Tasmania and New Zealand.

Strut.—To support with timber.

Stub.—To grub up by the roots.

Stuff.—Substance or matter. The word is often carelessly used to describe indefinitely some material used in road construction.

Sub-crust.—A new term used to designate the lower layer of the carriageway construction in the same sense as "strength-crust."

Super-crust.—Also a new term used to designate the top layer or wearing surface.

Subgrade.—Also a new term used to designate the lower layer of the carriageway construction.

Subsidence.—The act of sinking or gradually becoming lower.

Subsoil.—The under soil; the bed or stratum of earth which lies immediately under the surface soil.

Suburb.—From sub (near) and urbs (a city). An outlying part of a city or town, but adjoining it.

Subway.—An underground way or passage.

Sullage.—Filthy water or sewage.

Superimpose.—To lay on something else.

Supple.—Easily bent, pliable.

Surcharged Wall.—A retaining wall in which the earth behind it is higher than the wall.

Surface-coating.—The top coating of metal or other material laid on the surface of a carriageway.

Surface-crust.—The upper layer of a carriageway; also called the "wearing surface," or "wearing crust."

Surface Flints.—Sometimes called "field flints," to distinguish them from "pit flints."

Surface-sealing.—The final operation of closing and making waterproof the surface of a carriageway with a bituminous compound.

Surfacing.—A term used to designate all work done in connection with the surface of a carriageway. Also sometimes used as a noun to designate the top layer or wearing surface of a carriageway.

Swan-neck.—A curved pipe fixed on a water stand-post.

Sward.—The same as "turf," but referring to the surface only.

Syenite.—Comes under the trade name of "Granite," as settled by the Engineering Standards Committee.

Synthetic.—The quality of composition, or combination—i.e., the unity of elements into a compound.

Tableland.—A stretch of elevated flat land. Sometimes called a "plateau."

Tail-board.—The movable back of a tipping-cart or wagon.

Tail-drain.—The end drain of a series of drains in a field which empties into a ditch.

Tailings.—A term applied to the broken stone which does not pass through the largest openings of a screen.

Tail-race.—The stream of water coming from a mill after turning the wheel.

Tar.—"A thick, dark-colored viscous product obtained by the destructive distillation of coal, wood, peat, shale, etc."

Tarbetonite.—The trade name of a bituminous compound.

Tarco.—The trade name of a bituminous compound.

Tar-coating.—One of the numerous terms used to designate the operation of placing a thin coat of tar or other bituminous mixture on the surface of a carriageway.

Tar-dressing.—See "Tar-coating."

Tare.—The actual weight of goods after deducting the weight of the vessel or vehicle in which they are contained.

Tarite.—The trade name of a bituminous composition.

Tarlithic.—The trade name of a bituminous compound.

Tarmac.—The trade name of slag specially prepared with tar as a road metal.

Tarmite.—The trade name of a bituminous compound.

Taroomba.—The trade name of a bituminous compound.

Tar-painting.—See "Tar-coating."

Tarpaulin.—Canvas well treated with tar to make it waterproof.

Tarring.—See "Tar-coating."

Tar Slag.—See "Tarmac."

Tar-spraying.—See "Tar-coating."

Tar-spreading.—"See "Tar-coating."

Tar-sprinkling.—See "Tar-coating."

Tar-surfacing.—See "Tar-coating."

Tar-topping.—See "Tar-coating."

Tar-varnishing.—See "Tar-coating."

Tarvia.—The trade name of a bituminous compound.

Tar-washing.—See "Tar-coating."

Temper.—"To mingle, mix or combine properly in due proportion; to compound or blend." The word is applied to the treating of bituminous compounds in order to obtain their proper consistency.

Template.—A full-sized mould or pattern; a frame shaped to the contour or cross-section of the finished surface of the carriageway.

Tenacious.—Tough; resisting effort to pull asunder; apt to adhere to another substance; adhesive.

Tensile.—Capable of being stretched.

Tessellated.—Small stones of different sizes and colours laid as a "mosaic."

Texaco.—The trade name of a bituminous compound.

Thermal.—Pertaining to heat.

Thoroughfare.—A passage right through.

Tine.—The tooth of a scarifier.

Tipcart.—A cart that can be tilted or tipped without unyoking the horse.

Tissue.—The same as "Fibre."

Toe.—The base of an embankment.

Tooled.—Faced so as to show the symmetrical marks of the chisel or tool.

Toothing.—Bricks, stones, setts, etc., left projecting to give a bend for the continuation of the work.

Torqued.—Anything twisted.

Torsion.—The act of twisting or unravelling.

Tortuous.—Twisted, winding.

Tough.—The quality of flexibility without brittleness; firm, strong, tenacious, resisting wear or strains.

Trachyte.—Comes under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Track.—"A beaten way or path.." The term is applied to the marks of wheels in a carriageway where the traffic has followed the same line.

Tracking.—A term applied to designate traffic which follows the same course, and consequently forms ruts. The term is also sometimes applied to the act of repairing the tracks thus caused.

Traction Engine.—A steam locomotive engine for dragging heavy loads on roads.

Traffic.—A term applied to the amount of user of a road. "Light traffic" has been held to mean about 70 vehicles a day, including an occasional traction engine or heavy motor; "medium traffic" from 70 to 250 vehicles, including not more than 5 per cent. of traction engines or heavy motors; "heavy traffic," from 250 to 600 vehicles, of which 5 to 10 per cent. is traction engines or heavy motors; "very heavy traffic" exceeds this.

Traffic-duty.—A term sometimes used to designate the amount of traffic which a carriageway has to carry successfully.

Trafficway.—A term sometimes employed to designate the carriageway.

Trailer.—A vehicle attached to the rear of a traction engine or heavy motor.

Travelled.—A word sometimes used to designate a road in which there is traffic; a "heavily travelled road, for instance, denotes a road with a large amount of traffic.

Traverse.—Method of making a rough survey.

Trench.—A long, narrow cut or ditch.

Trestle.—A movable prop or frame.

Trinidite.—The trade name of a bituminous filler, etc.

Trivet.—A three-legged stand.

Trunk Roads.—Sometimes called main trunk roads. A term applied to roads leading from one great centre to another.

Tubbing.—The lining of a well or shaft.

Tuff.—Comes under the trade name of "Grit," as settled by the Engineering Standards Committee.

Tumbrel.—A description of tipping cart.

Turbid.—A term applied to a thick, cloudy liquor.

Turf.—The surface of a sward of grass land; plural "turves."

Turgid.—Distended, bloated.

Tussock.—A clump or tuft of grass.

Tynes.—See "Tines."

Tyre.—The band of iron or rubber covering the circumference of a wheel.

Ugite.—The trade name of a bituminous compound.

Undulating.—Having an outline or profile resembling a series of waves.

Uneven.—Not level; rough, rugged.

Upkeep.—Maintenance.

Vacuity.—Space unfilled or unoccupied.

Vacuous.—Empty, unfilled.

Vacuum.—Empty space; a void.

Valley.—A surface depression, surrounded by hills or mountains.

Van.—A term usually applied to a vehicle used by tradesmen for carrying goods.

Verdure.—Freshness or greenness.

Verge.—"The extreme side or edge of anything"; margin, brink. Usually applied to the grass edge of a carriageway.

Viagraph.—An instrument for measuring the inequalities of a carriageway surface.

Vibrate.—To swing or oscillate.

Viscid.—Having a glutinous, semi-fluid, sticky consistency.

Viscosity.—Glutinous, tenacious, sticky.

Viscous.—Glutinous, clammy, sticky, adhesive, tenacious, tacky.

Vista.—A view or prospect seen through an avenue.

Vitreous.—Appertaining to glass; glassy; consisting of glass or akin thereto.

Vitrify.—To convert into glass.

Vitriol.—Sulphuric acid, etc.

Voids.—See "Interstices."

Volatile.—Evaporating quickly.

Volatilise.—To cause to evaporate.

Voussoir.—The stones forming the arch.

Vulcanite.—A chemically hardened rubber; sometimes also called "ebonite."

Vulcanol Pavement.—The trade name of an artificial paving tile or brick.

Wagon.—Or "Waggon." A four-wheeled vehicle for the transport of heavy goods.

Wain.—A kind of wagon for the transport of hay.

Warp.—To turn, twist or shrink.

Warrenite.—The trade name of a bituminous mixture.

Wastage.—A term sometimes used to designate deterioration or wear.

Water-bound.—A term now applied to carriageways constructed with broken metal, gravel binding and water to distinguish them from the roads made under the modern method of bituminous-bound carriageway construction.

Water-channel.—A term sometimes applied to the channel at the side of a carriageway. See "Channel."

Water-consolidated.—See "Water-bound."

Watercourse.—A channel or canal made for the conveyance of water.

Water-gas Tar.—See "Oil-tar."

Waterproofing.—"The act of rendering impervious to water"; sometimes applied to the application of a "seal coat" to the surface of a carriageway.

Watershed.—The area from which rain water is gathered, or from which it flows in a particular direction.

Water-table.—See "Channel."

Wavy.—Or "Wavey." "Showing waves or undulations." Applied to the surface of a carriageway which has this defect. Many theories have been suggested to account for these waves.

Way.—"A place for passing; a path, route, road, street or passage of any kind."

Wayleave.—A right of way or easement.

Waypost.—An old term for a signpost.

Wayside.—The border or edge of a road.

Wear.—The act of wearing; diminution by friction, use, time, etc. (The wear of a road must not be confused with "deformation").

Wearing Crust.—A term now sometimes applied to the upper layer of a carriageway which is exposed to the action of the traffic.

Wearing Surface.—See "Wearing crust."

Weep-holes.—Holes left in a retaining wall to prevent water accumulating behind it.

Westrumite.—The trade name of a "mixer."

Wheelers.—A term applied to stone blocks laid parallel to the kerb in a street to take the wheels of heavy traffic.

Wheelway.—A term sometimes used to designate the carriageway.

Of Winnipeg's fine architectural features one of the most interesting completed recently is a handsome structure for the housing of the Y. M. C. A. The new building, located on Vaughan Street, has a frontage of 175 feet and a depth of 120 feet. It is built entirely of reinforced concrete, with front and side walls of Tyndall stone, Menominee brick and terra cotta, the rear wall being of local brick. All of the more public rooms are connected with a ventilating system and the water supply is from a well on the premises, 417 feet deep, the water being forced through the building by compressed air. The features of the main floor are the spacious lobby and reception hall, inglenook and fireplace, general office, board room, and the association hall with a seating capacity of 450. An innovation in the form of a running track, nineteen laps to the mile, covered with cork carpet, has been provided on the third floor. The three top floors contain 128 bedrooms, and, on every floor, toilet, shower baths and telephones are installed. The building is also well equipped in the matter of gymnasium and other facilities for physical culture, and has involved an expenditure of $413,734, including $37,500, the cost of the site.

Canadian City Engineers

Mr. Wm. Ramsay, Fernie, B.C.

Mr. Wm. Ramsay, City Engineer of Fernie, B.C., entered the engineering department of the Dundee (Scotland) Corporation in September, 1895, and was articled to Mr. Geo. Baxter, M. Inst. C.E., Waterworks Engineer. While serving his articles he took an engineering course at Dundee University College under Professor Fidler and obtained diplomas in junior engineering, descriptive engineering, land surveying and levelling. Continuing in the service of the Dundee Corporation until 1906, he eventually became assistant waterworks engineer in charge of all survey work. The responsibilities in this connection were not small, for Dundee is a thriving town with a population of 162,000. During the eleven years that Mr. Ramsay was in Dundee many improvements were carried out in the waterworks system. These included additional mains, better fire protection, covered concrete culverts in place of open aqueducts, sand filters and clear water reservoirs. All the details for these improvements were in the personal charge of Mr. Ramsay who made up the specifications and schedules of quantities.

City Engineer Ramsay, of Fernie, B.C.

The last work upon which Mr. Ramsay was engaged in Dundee involved an expenditure of $375,000. At the time, Mr. Ramsay was identified with Messrs. D. Y. Stewart & Company, of Glasgow, by whom he was appointed resident engineer on rather an exceptional piece of work, namely, the lifting of 4¾ miles of 27 in. cast iron trunk main and replacing it with the same size of main but with different joints. This main portion working under a pressure of 480 feet or 208 pounds to the square inch caused constant trouble from bursting at joints which were leaded and driven. To obviate this the joints on the new main were simply roped, leaded and caulked. The old main was broken by means of a pear-shaped weight of 1,700 pounds, dropped from a height of twelve feet, and the old metal was shipped back to the pipe founders and recast. Upon the completion of the work tests were made and not a single leaking joint was discovered, although in places the ground was so treacherous that the pipes had to be laid on piles driven eight feet into the ground.

Mr. Ramsay came to Canada some two years ago and was appointed City Engineer of Fernie, in June, 1912, in succession to Mr. Robert Potter, now of Battleford, Sask.

Vancouver Closing with Strong Finish

Unabated Activity in Large Building Work — Progress Reports on the Hotel Vancouver and other Important Structures

THE mild weather experienced at the Coast has proved a boon to the various contracting firms in Vancouver that are making strenuous efforts to complete as much exterior work on buildings as possible before the heavy winter rains set in. Considerable activity is in evidence at various points throughout the city, but more especially in the commercial sections, where many structures of a substantial and permanent description are rapidly assuming form, the number of men kept steadily employed being still very large on account of the extensive nature of the projects under way. Almost six hundred men are engaged on the construction of the new Hotel Vancouver and the Hudson's Bay Company's addition, the latter contract necessitating an extra force of skilled labor just recently in order to expedite the progress of the work as much as possible. Then there are such structures as the fifteen-storey Weart Building, the ten-storey Yorkshire Guarantee block, the ten-storey Credit Foncier Building, the B. C. Telephone Company's new central exchange—an eight-storey structure, and several others in various stages of construction, each of which requires a large body of skilled labor.

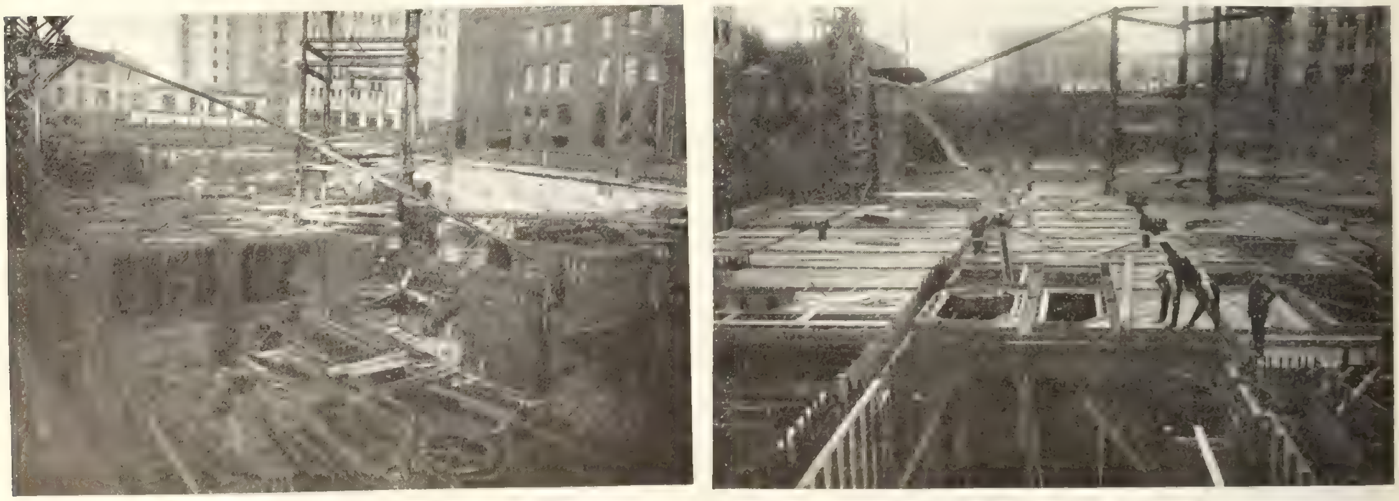
It must be admitted, however, that in the residential districts within the city limits there has been a considerable falling off in the volume of construction during recent months, this decrease being particularly noticeable in contrast to the remarkable activity exhibited in the building of dwellings in previous years. How long this state of affairs will continue must remain a matter of conjecture for the present, at any rate. The question of securing sufficient capital is still apparently proving as great a problem as at any previous period during the year just drawing to a close, and judging from the number of large undertakings which are held up on account of this very difficulty, it seems apparent that the opening months of the coming year will prove comparatively quiet ones where building construction is concerned.

It is believed that Vancouver's standing in the world's money market will be much improved as a result of the decision of the city council, recently made public, to submit no money by-laws to the electors in January, 1914, in view of the present unsettled financial situation. In commercial circles there is a decided tendency towards optimism regarding the outlook for the year 1914, reliable authorities forecasting a gradual betterment in conditions from March 1 onwards, this prediction in the main being founded on the fact of this year's splendid crop in the north-west, and its probable effects on the situation in British Columbia. That the readjustment now taking place in all lines of commerce represented locally will prove beneficial to the entire community there can be no doubt, the necessity for establishing business on a more solid basis, particularly in the cities at the Coast having long past been recognized by those who are directly interested in the development of the province as a whole.

Hudson's Bay Company's Store Addition

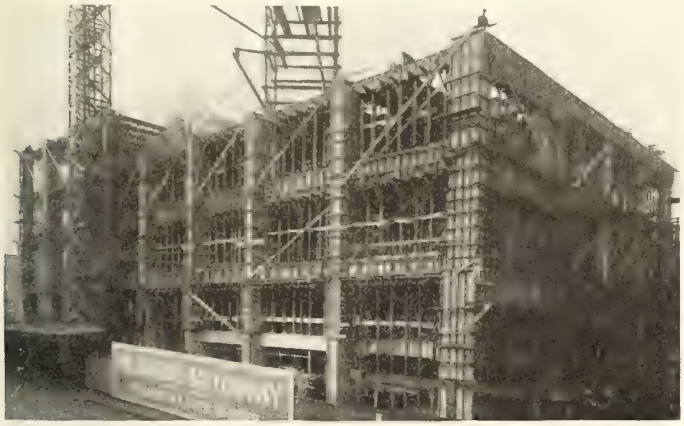
Despite the unusually heavy nature of the work, very satisfactory progress has been in evidence since constructional operations commenced on the six-storey addition to the Hudson's Bay Company's store in Vancouver. The site of the building at the corner of Georgia and Seymour streets occupies an area 146 x 175 feet, and as bedrock lies about 50 feet below the surface at this point, the work of excavating for the foundations proved an immense task, and one which severely taxed the resources of the contractors. Before reaching bedrock, it was found necessary to remove about forty feet of hard pan, which in Vancouver resembles a natural cement in hardness. While it is admitted that this material alone would have provided an excellent foundation, the specifications called for a deep basement and excavation was therefore continued to the depth required. In addition to the extra strength of the basement, the supporting columns and sidewalks are alike being constructed sufficiently strong to carry five additional storeys should these be required in the future. The engine room, sub-basement and basement floors below ground have been completed, and at the present time concrete is being poured on the fifth floor above grade, with every prospect of the concrete frame being entirely finished at the end of the year.

It has been estimated that the concrete work in this structure is the heaviest ever undertaken in a local building. The upright supports comprise 59 columns of reinforced con-



New addition to the Hudson's Bay Company's building at Vancouver, showing (on the left) smoke breechings and tunnel, and (on the right) basement floor construction.

crete, each embedded in a concrete foundation measuring 8 feet square at the sub-basement floor, the dimensions of the columns themselves being 4 feet square, tapering at the rate of two inches to each floor. One hundred and seventy men are at present employed on this structure, which will form only one-half of the entire contract, a duplicate portion with frontage on Granville and Georgia streets being planned for erection immediately following the completion of the portion now under construction. Fireproof construction consisting of steel and concrete with terra cotta facing will be employed in both sections, the street elevations being relieved by rows of Corinthian columns placed between each row of windows. The interior fittings and fixtures will conform with the latest ideas adopted in buildings of the departmental store type, and the total expenditure involved will be over two million dollars. The architects are Messrs. Burke, Horwood & White, of Toronto.



Hudson's Bay Company's addition. Seymour street front.

The New Weart Block

Noteworthy progress on this immense structure has taken place in the last few weeks, and at the present time 10 out of the 15 storeys of steel frame work are in position, with fair prospects of the remaining five storeys being erected early in the new year. The foundations of the building rest on rock about 25 feet below the surface. The ground measurements are 78 x 120 feet, and the height from the pavement to the roof will be 175 feet. Briefly, the main constructional features comprise terra cotta facing for the three lower storeys, with a polished granite base, face brick for the succeeding eight storeys and terra cotta in the four remaining storeys. The architects, Messrs. Russel, Babcock & Rice, of Vancouver, have adopted the Francis I. style of architecture, in which the general effect is Gothic with the details in Renaissance—a blending of classic and Gothic decorative forms.

The design of the main entrance vestibule conforms with the architecture of the exterior, the wall and floors being of marble with bronze trimmings, the ceilings of oak beams and panelling. The general vestibule leading to the main corridor will be 25 feet wide. All corridor floors are to be finished in Terazzo tile, with marble borders.

The typical floor will contain 30 offices, finished in oak. The Canadian Ferro Concrete Company is handling this contract, which has been estimated at approximately $700,000.

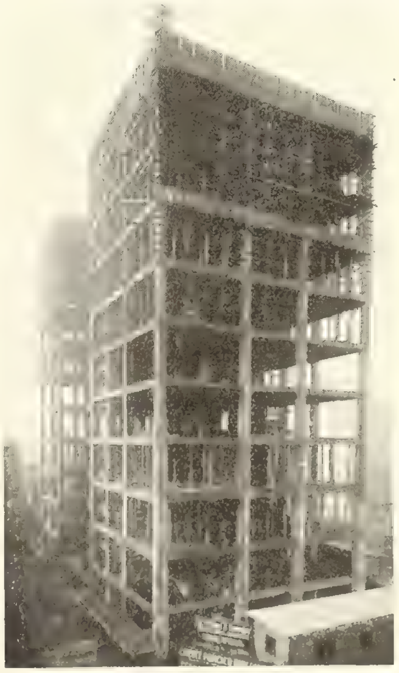
The Credit Foncier Ten-Storey Office Block

During November, work on the Credit Foncier office building was actively prosecuted, the reinforced concrete frame being erected to the full height of ten storeys before the end of the month. This large concrete structure occupies a site at the corner of Hastings and Hornby streets in Vancouver, and was planned by Messrs. H. L. Stevens & Company, Vancouver, in collaboration with Messrs. Barott, Blackader & Webster, architects, of Montreal, the work of construction being also carried on by Messrs. H. L. Stevens & Company. The exterior will be finished with cut stone and terra cotta, surmounted by a copper cornice. All corridors will be finished with marble wainscotting and terrazzo floors. The floors of the offices will be finished with rock maple. All the offices, with the exception of those to be occupied by the Credit Foncier on the ground floor, will be decorated in oak, mahogany being chosen for the quarters of the Credit Foncier. The equipments throughout will be of the highest standard used in office block construction.

New Central Exchange for B. C. Telephone Co.

Work was resumed at the beginning of November on the new eight-storey Central Exchange Building, which is being erected for the B. C. Telephone Company in Vancouver, on Seymour street, between Georgia and Robson streets. The skeleton steel frame work is mounting steadily upward, and it is understood that every effort will be made to erect the steel for the entire eight storeys by the middle of January. The frontage on Seymour street is 50 feet, and the depth to a lane, 120 feet. The type of construction to be adopted in this building is steel frame and reinforced concrete work, with pressed brick and terra cotta as exterior facing on the front elevation, and common brick for the side and rear elevations. The decorations of the main entrance will be in marble and tile. The head office of the telephone company will have accommodation in this building and provisions will also be made for four telephone exchanges, the equipment of which will be of the most complete description. Plans for the structure were prepared by Mr. J. Johnson, supervisor of the company's building department.

Messrs. Campbell & Wilkie, the contractors who are constructing an elaborate moving picture theatre for the Rex Amusement Company in Vancouver, are making excellent progress with the work, and expect to complete the building early in the new year. The contract involves the alteration of an existing three storey and basement brick building formerly occupied by Messrs. Wood, Vallance & Leggat, on Hastings street, near Carrall street. The theatre will include a main auditorium floor, seating 1,000 people, two stores, 15 x 25 feet, an outside lobby, 12 x 32 feet, and



Credit Foncier office building under construction at Vancouver

an inside lobby, 25 x 32 feet. The work practically comprises a new front elevation in concrete and Meduca cement and the entire remodelling of the interior. Mr. Philip M. Jullien, Vancouver, is the architect. The cost is expected to reach about $40,000.

A contract was recently awarded to Carkeek & Company for the erection of a new building which will form the first section of the B. C. Pottery Company's new plant at Esquimalt, to replace the factory destroyed by fire some months ago. The new building is to be of mill construction, three storeys in height, and will cost about $20,000. It will contain the necessary equipment for the manufacture of modern earthenware. The contract calls for the completion of the work within sixty days.

Mr. E. J. Molloy recently secured the general contract for the erection of a moving picture theatre on Bridge street, Vancouver, for Mr. R. Oakes, at a cost of approximately $20,000. The dimensions of the building will be 28 x 111 feet, and one storey in height. It will rest on a concrete pier foundation, and will be of brick construction with terrazo tile for the entrance lobby. A hot water heating system is to be installed. The structure is typical of the class to which it belongs and possesses no novel features whatever. Mr. C. P. Gregory, Vancouver, was the architect.

The proposed detention building at William Head, near Victoria, for which the Department of Public Works at Ottawa received tenders until November 17th, will be a reinforced concrete structure costing about $45,000. The general design of the building shows a centre-piece and two wings, the former being utilized for assembly functions and the latter representing the various cabins and sleeping accommodations. Extending over a length of 152 feet, the building has two storeys at the wings and three storeys in the centre. All the individual cabins are fitted up with hot and cold water, separate baths, electric light, etc. The feature of the central portion of the structure is the great dining hall, which occupies the entire width of the block and almost the entire depth, the margin of the latter being reserved for the kitchen. Immediately above the dining hall there is provision for another great hall, which will probably be utilized for assembly purposes. Plans were prepared by Mr. Wm. Henderson, of Victoria.

It is reported that tenders will be invited immediately for the erection of the proposed brick additions to the Vancouver General Hospital, for which Mr. A. A. Cox, Carter-Cotton Building, Vancouver, has completed working plans.

As a result of a public meeting held in Merritt recently, it is proposed to erect a large building in the town to accommodate a skating and curling rink. The rink is to be about 120 feet x 180 feet with two curling rinks side by side at one end and a large skating rink at the opposite end of the building. Dressing rooms for both sexes will be provided and the scheme will involve an outlay of approximately $10,000.

The Vancouver board of school trustees has approved of the construction of a new eight room building on the Children's Aid Grounds, an eight room school building in Hastings Townsite, and an eight-room addition to the Livingstone and Model schools. The school board having dispensed with the services of its regular architect, it is probable that a committee of three local architects will be appointed to act in an advisory capacity in connection with the construction of the Vancouver city schools in future. Preliminary plans and specifications will be prepared in the school board offices by the regular staff of draughtsmen, but before any contracts have been awarded the committee of three will examine the plans and suggest any alterations that may be found necessary. It is understood that the committee will supervise the erection of the schools and be paid on a commission basis. Members of the board feel that under the new arrangement the school buildings will be improved and will be more varied in architecture than if one man designed them year after year.

It is understood that Messrs. Somervel & Putnam, the well-known Vancouver architectural firm, is preparing plans for the proposed palatial residence of Mr. B. T. Rogers, manager of the B. C. Sugar Refinery, Vancouver. The residence will be situated in Shaughnessy Heights, and while constructional details are not available at the present time, it is admitted that the structure will be a very elaborate one, and erected at considerable expense. Messrs. Hodgson, King & McPhalen Brothers, of Vancouver, have been awarded a contract for the gate lodge to be erected on the site, but construction of the residence itself is not expected to be undertaken before next spring.

Notification has been received in Vancouver from the Deputy Minister of Public Works at Ottawa that British Columbia sandstone and British Columbia Douglas fir will be specified in connection with the new immigration detention building to be erected in Vancouver, and all other public works in British Columbia as far as possible.

The Ritchie Contracting & Supply Company, Limited, Vancouver, recently received an order from the contractors of the Hudson's Bay Company's new Vancouver building, Rourke, McDonald & Moncreiff, for about 100,000 Kittenning face brick. This is the third large order procured by the company for this class of brick during recent weeks, the three orders being in the vicinity of 100,000 bricks each.

The Canadian North Western Steel Company, of Vancouver, were recently awarded a contract covering all the steel work required for the new provincial government bridge at Taghum, near Nelson, this firm's tender approximating $4.45 per thousand pounds of metal. The concrete substructure and the work of erection were awarded to Messrs. Hodgson, King & McPhalen Bros., another Vancouver firm, at a price of approximately $55,000. The total cost of the structure will be about $75,000. The contractors have been instructed to commence operations immediately.

What is described as a departure from the usual methods followed in road making is being adopted by the M. P. Cotton Company, of Vancouver, on the western portion of Kingsway, at Port Coquitlam. Starting on the usual subgrade of sand or earth, a heavy layer of good sized rock is first laid and well rolled, then a thick coating of tar-pitch is put on hot, after which the top layer of fine rock is laid and the whole thoroughly rolled. The contractors claim that this process gives a greater amount of solidity than the ordinary macadamized road, and afford a spring to the road which enables the surface to last much longer. The experiment is attracting a considerable amount of interest in the district.

It is the intention of the firm of Messrs. Aldous & Murray, Limited, Vancouver, joint owners of the townsite of Smithers to put in a gravity water system at this general divisional point on the Grand Trunk Pacific Railway in the interior of British Columbia. Negotiations are under way for the installation of the plant, and work will be started with the least possible delay. The Bulkley River, which flows past the townsite, will supply all the requirements of the district, the source of supply being ideal, the water clear and pure, while the problem of distributing it to all parts of the townsite is a very simple one. Water will be pumped from the Bulkley River above the town, the point of diversion being 400 feet north of the south line of section 31, township 4, range 5, Coast district. A Fairbanks-Morse engine of 8 h.p. will operate the pump which will have a capacity of 130 gallons per minute. The water will be lifted to a reservoir, located on the height of land above the town, which will have a capacity of 50,000 gallons. The water will be supplied to all parts of the townsite by gravity system.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The new children's hospital, now in course of erection in Hamilton, is expected to be ready for occupation by February 1. Mr. Robert New is the architect.

It was stated by Mr. G. L. Parsons, superintendent of the grain elevator, that 11,000,000 bushels of grain are handled annually, making Goderich the second largest grain port on the Upper Lakes.

The Balmy Beach sewerage system, draining the territory south of Queen street, Toronto, is almost completed and it is expected the whole system will be in operation before the new year.

St. Catharines city council is considering a by-law to make an addition to the Canada branch of the Russell-Jennings Manufacturing Company, the products of which will be augers, auger bits, tools and hardware.

According to reports the Imperial Oil Company have purchased at Sarnia a three-acre site for the erection at a cost of about $1,000,000, of a factory for the manufacture of crude oils into greases and other products.

By-laws will probably be passed by the city of Hamilton authorizing the borrowing of $200,000 for the erection of hospital buildings upon the new site on the mountain top; also for $125,000 for improvements to Barton Street city hospital.

An order winding up the Dominion Roofing Company was made by Chancellor Boyd at Osgoode Hall on December 16, Mr. G. T. Clarkson being appointed liquidator. The company was incorporated in August, 1912, with head office in Toronto.

The Plymouth Cordage Company, said to be one of the largest of its kind on the continent, is contemplating the erection of a large distributing warehouse at Fort William similar to the one now in operation by the International Harvester Company.

Mr. Thomas Crawford, Clerk of Scarboro Township, has applied to the city of Toronto for a supply of water to the residents of Victoria, Blantyre, Chester, and Lakeview Avenues in the township. The application will be dealt with by the Works Committee.

The new bridge over Dog Lake, Kingston, which will be 300 feet long, is to be built by day labor, the cost to be borne jointly by the county of Frontenac and the township of Storington. The work will be superintended by the chairman of good roads and bridges for 1914.

The Steel Company of Canada is erecting a factory at Fort William for the manufacture of nails and spikes. The installation of machinery will shortly be commenced and work will be in operation early next spring. It is anticipated that about 1,500 men will eventually be employed.

The abutment of St. Clair bridge, Toronto, which with the western piers has been recently finished, is considered one of the finest specimens of concrete work on the American continent. The mass consists of about 3,000 tons of material and though not plaster finished is as smooth as stonework.

The York county highway commissioners have received some useful hints from the Good Roads Convention at Philadelphia which they attended recently. It is likely that an improvement in the present roads of York county will result. Toronto will probably be the meeting place for next year's convention.

It is stated that a large cotton mill will probably be established in Welland by the Toronto Cotton Company. It is understood that the proposal of the company is to have an annual payment of $50,000 made to them, the town to erect the building which would afterwards be purchased by the company.

By-laws will probably be sought in connection with the proposal to extend the London, Lake Erie Railway and Transportation Company from St. Thomas, Ont., to Aylmer and Port Burwell. It is said that the municipalities are prepared to give a free right-of-way to the company for the construction of the line.

The new covered bridge which spans the Cocagne River on Victoria Road, Moncton, is now practically completed by the contractors, Messrs. A. E. Smye & Son. The length of the work, including approaches and roadway, is nearly 1,000 feet. Howe trusses are used, the spans being supported by concrete piers with stone riprapping, built-in pits excavated to a depth of firm foundation.

As a sequel to the Lakes disaster the coroner's jury recommends that the government, regardless of cost, equip Goderich harbor by completing the breakwater now begun, by installing up-to-date lights and fog signal at the entrance of the breakwall by dredging to the necessary depth the outside basin formed by the breakwall. A wireless installation for the lakes is also recommended.

The annual good roads report on the year's construction as presented to the Welland county council shows an expenditure of $58,427, of which the county will receive a refund of one-third from the government. The roads built in the neighboring townships cost about $4,000 per mile. There appears to be some agitation in favor of a more permanent class of road than is now being constructed in the county.

The Daprato Statuary Company of Chicago have secured the contract for constructing the main altars and two side altars for the basement of the new St. Dunstan's Cathedral, Prince Edward Island, also the altar for the private chapel in the Archbishop's palace. This will be of Sagliola artificial marble finished in white veined carrara marble effect. The altar for the palace chapel will be of rigalico which is made of English Keene cement.

In St. John, N.B., more than four thousand feet of the seven miles of water mains have been taken out and replaced by pipes of at least eight inches diameter during the present year. In west St. John seven thousand feet of the old sheet iron mains have been replaced with eight-inch cast iron pipe, the work being carried out by Mr. Wigmore commissioner's department, who is active in his efforts to bring the city water system up to the modern standard.

An impression of the magnitude of civic works carried out under the direction of the Toronto Works Commissioner, Mr. Harris, will be gathered when it is stated that over 23 miles of sewers, 54 miles of pavements and 68 miles of sidewalks were constructed during the year. Five miles of macadamized roadways were re-surfaced and the length of sidewalk from which the snow was cleared opposite vacant properties, and for which the owners were charged, was 446 miles.

Among the many large institutions on which work has been rushed throughout the season is the plant of the Canadian Car & Foundry Company, Limited, in west Fort William. The structure is of steel and the plant which is being installed at a cost of a million and a half dollars will turn out complete freight and passenger cars. Work will be in operation early next summer when it is expected that employment will be found for between two and three thousand.

The salesmen of Messrs. Bird & Son, Hamilton, Ont., held their annual meeting in Hamilton last week. The company are well-known as the manufacturers of the now famous "Neponset" products, consisting of Paroid roofing, waterproof building papers and Neponset wall-board. Representatives were in attendance from points as widely separated as East Walpole, Mass.; St. John, N.B., and Vancouver, B.C. Mr. Geo. E. Messer has been manager at Hamilton for the last two years.

The Montreal Builders' Exchange have written to the mayor and controllers complaining of the inadequacy of the building inspectors' staff and alleged disregard of the by-laws in relation to permits. It has been found that in some instances permits are not taken out until the buildings are partly completed, and in others houses have been occupied before the permits have been applied for. The Builders' Exchange desire that the penalties for violation of the laws should be enforced more strictly.

Dr. J. W. McCullough, Provincial Officer of Health, Toronto, gave an interesting address on sewerage problems before the Niagara District Medical Association at Welland club, December 13. Dr. McCullough was positive that the government would build a pipe line from Port Colborne all along the canal to supply fresh lake water, the intake to be about a mile out in Lake Erie. In the discussion which followed it was stated that the problem of leakage troubles is now under investigation by a government commission.

That Port Arthur has grown steadily during the past year is shown by the large number of buildings that have been erected. Among these is an eight-storey office for the Whalen interests at a cost of $450,000, which is expected to be completed by the end of the present year. The government have just completed a new elevator with storage capacity for 2,260,000 bushels of wheat in order to meet the increasing quantity of grain being handled in the city. Nearby the firm of Davidson & Smith are erecting an elevator and flour mill, while in the same part of the city the C. N. R. have added storage tanks with a two-and-a-half-million bushel capacity at a cost of $6,357,000.

Fort William's finest office building, the Grain Exchange, is the first large international building to be erected at the head of the lakes. The contract was awarded the A. C. Stewart contracting company last February when the work of excavation was immediately commenced. Concreting the basement was begun early in April and despite adverse weather and other conditions the work was completed in October. The plans called for reinforced concrete construction with an exterior of brick. The foundations extend twenty feet below the ground level which is eight feet below the sewer level, and rest upon wooden piles varying in length from forty to seventy feet according to variations in the depth of the rock. The building, which cost $320,000, is five storeys high with a deep basement, the dimensions being 100 x 125 feet.

The Quebec Government have introduced a bill to assist in the construction of dwelling houses. It empowers municipal councils to guarantee the loans of a company incorporated to build dwelling houses intended to be let at a moderate price. The loans are only to be guaranteed by a municipality provided additional dwelling houses are required properly to house the people who live or work within its boundaries. The object of the company is in good faith to furnish comfortable dwellings, and not to make a profit greater than six per cent. per annum. The by-law authorizing the loan is only to come into effect after approval by a majority of the electors who are proprietors. The guarantee of the municipality is to be protected by a first mortgage on the houses and lands, and the total amount of the loan is not to exceed eighty-five per cent. of their value.

WESTERN CANADA

A by-law is to be submitted to the ratepayers authorizing the city council to borrow $150,000 for the purpose of rocking, planking and macadamizing streets and lanes in the city of Vancouver.

Splendid progress is being made by the Canadian Explosives, Limited, in the construction of their new works on James Island, B.C. About one hundred and fifty workmen are engaged on the work.

The Department of Works, Ottawa, has awarded a contract for the erection of a wharf at Gillis Bay, B.C., to Hodgson, King & McPhalen Bros., Vancouver. The amount of the tender is not made public.

Building contractors, painters and decorators from all over Western Canada will meet in Edmonton early in February when questions of importance to these industries will be discussed by prominent members.

The western association of the Builders' Exchanges will hold its first convention early in February. The western body it will be remembered, divided from the eastern section at the last convention of the Canadian National Association of Builders' Exchanges. This inaugural function bids fair to be an unqualified success.

At Tranquille, eight miles west of Kamloops, B.C., a tuberculosis sanitorium is to be erected at a cost of $150,000. At last hearing tenders had been called but no contracts awarded. The building is to be four storeys high of reinforced concrete construction. Messrs. Dalton & Eveleigh, of Vancouver, are the architects.

In an action brought by Mr. H. P. Hazell against the Standard Milk Company as owners and J. J. Dissette & Company as chief contractors, Vancouver, for damages for $1,988 for material and labor supplies, Judge Grant ruled that under the Mechanics Lien Act a sub-contractor who has paid all his labor and material bills is entitled to succeed in lien action against the owner even though he has failed to fulfil the section of the act which provides that he must post up on the work his receipted pay-roll the first day after pay day.

The Government has given expression of its recognition of Fort William's rapidly growing importance in Dominion affairs by starting in the early autumn the erection of a customs house at the corner of May and Leith Streets which will cost $200,000. The imposing structure will be two storeys and basement, 100 feet long by 80 feet wide. The foundation work is well under way. The government has also asked for tenders for a modern armory and drill hall to be built in Fort William, which will be one of the most modern in the country. A site has already been provided for the armory.

With its natural beauties and the art of the town planner the district of South Winnipeg has come to the front as one of the choice residential localities surrounding that city. Together with the town planning and actual laying out has gone forward the installation of asphalt pavements, etc. A subway will shortly carry the traffic under the railway tracks which cross Arlington Street, this having been already ordered by the railway commission. The engineering building of the University of Manitoba is well under way and thirty-two of these buildings have been planned to adorn the government reservation.

Canadian Railroad Development

The feasibility of constructing a railroad from the Yukon to Alaska, with Edmonton as a starting point, was discussed at a recent meeting of the Edmonton Board of Trade. Some of the main features of the project were dealt with by Mayor W. A. Greisbach who led the discussion.

Mr. D. B. Hanna, vice-president of the Canadian Northern Railway, has given a pledge to St. Catharines city council that in the construction of the line from Toronto, through Hamilton to the Niagara River, the section between Grimsby, Beamsville and St. Catharines, will be completed within two years.

City Engineer Latornel has prepared plans for sixteen subways, costing $1,160,000, to be built under the main lines of the Grand Trunk Pacific and the Canadian Northern roads at Edmonton. The cost of raising the tracks for the subways is estimated at $80,000. Track raising to a height of twelve feet is estimated to cost $2,000,000.

The Intercolonial Railway at Truro is about to open one of the finest stations on its line. The new building is a handsome structure of red sandstone with rock-faced body and dressed trimmings. It is 380 feet long, 55 feet wide and is surmounted by a tower on the street side, 19 feet square and 78 feet high. From each end to the central part there is an extension, the one to the north being 80 feet long by 50 feet wide and the one to the south 121 feet long by 50 feet wide. The foundations are of concrete and the floors of reinforced concrete and structural steel. The roof is supported by steel roof trusses being built of slow burning wood covered with pitch and gravel. The walls for a height of seven feet are tiled, the upper part and the ceiling being done with rough-cast plastering, with finishing cornices, beams, etc. All the wood finishings are quartered golden oak and a ten-foot verandah supported on structural brackets with roof covered by asbestos shingles extends along the whole track front and around both ends.

The building of the Canadian Pacific Railway tunnel, five miles long, at Rogers' Pass, B.C., in connection with the double-tracking work in Calgary and Vancouver, has been let to Messrs. Foley, Welch & Stewart. In addition to the boring of the tunnel the contract calls for the construction of 11.1 miles of double track approaching the eastern portal and 2.3 miles approaching the western portal. The work will reduce the height of the summit at which the line crosses the Selkirks by 537 feet, will eliminate 4.4 miles of distance and 2,500 degrees of curvature and on fifteen miles of track the gradient will be reduced from 2.2 to 1 per cent. The tunnel will be a single one carrying a double track 30 feet wide by 20 feet high, and in the boring a new method will be adopted. Instead of boring simply through both ends it has been decided to bore a pioneer tunnel 7 feet by 8 feet parallel with the main tunnel and cross-cut at short intervals so as to enable several headings to be worked simultaneously. The boring of the pioneer tunnel which will add ventilation to the railway tunnel during construction has been started and about the end of December the first cross-cuts will have been completed. The project is likely to cost the C. P. R. about $8,000,000, the plant alone for the boring of the tunnels involving an expenditure of half a million. An interesting feature of the work is the erection of model villages at the two portals of the tunnels at a cost of $50,000. The work which will take about three years to complete is the biggest single feature that the C. P. R. has undertaken.

Constructional Interests Re-organized at Vancouver

SATISFACTORY progress is reported in connection with the organization of the various building and allied interests which have become members of the Vancouver Builders' Exchange, and by January 30th next the Secretary of the Exchange, Mr. W. Hamilton-Lindsay, hopes to complete the work of forming the members into their respective sections.

Following is a list of the different divisions proposed: general contractors; electrical contractors; general supply houses; sheet metal manufacturers; glass dealers; hardware merchants; brick manufacturers; machinery houses; electrical supply firms; elevator manufacturers; wholesale paint and oil merchants; structural steel fabricators; cabinet manufacturers; stone and quarry operators; sash and door manufacturers; ornamental iron workers; painters and decorators; plumbers; plasterers.

A number of sections have already been organized, and these are getting down to work in a fashion which indicates that a strong association will be the result. Among the important matters under discussion at the present time are the provincial lien law and the question of a uniform contract for contractors and sub-contractors. A feeling of general dissatisfaction exists in British Columbia regarding the operations of the lien law and every effort will be made by the exchange towards persuading the provincial authorities to adopt a more satisfactory measure.

Other matters pertaining to the welfare of the building and allied trades will be brought up for discussion in the course of the next few weeks, and presented in the form of resolutions before the first annual meeting of the Exchange, February 3, 1914, at which a revision of the existing by-laws will be made and the officers elected for the ensuing year.

The membership of the Exchange is steadily increasing, and it is hoped that as a result of the vigorous campaign which the secretary is conducting at present that a total of 150 members will be enrolled before the date set for the annual meeting.

Personal Mention

At the annual meeting of Saskatoon Builders' Exchange Mr. J. Priel was re-elected president, and Mr. A. W. Cassidy, first vice-president, both appointments being for a third term.

Prof. E. J. McCaustland, professor of engineering at the University of Washington, has been appointed consulting engineer for the construction of $3,000,000 worth of county roads in King County, Washington.

It is rumored in Ottawa circles that Major R. W. Leonard, chairman of the Transcontinental Railway Commission, will be among those upon whom the King will confer New Year honors, and that a knighthood will be given him in recognition of his various services to the Dominion. Major Leonard is one of Canada's best known engineers and a man of considerable wealth. A gift of half a million dollars from him to Queen's University for military training was recently announced.

Mr. David Ewart, chief architect of the Department of Public Works, Ottawa, is likely to be retired shortly at his own request. Entering the public service in 1871 as assistant engineer and architect of the public works department, Mr. Ewart has been at the head of the architectural branch since 1897 and has designed most of the public buildings erected in Canada since that time. He was decorated with the Imperial Service Order in 1903 and was also honored by the French government in connection with designs for the Canadian buildings at the Paris Exposition.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brantford, Ont.

The following sewers are recommended by Board of Health. Alice, Gordon, North Park and St. Georeg Sts., Henry Ave. and Elliott Ave. Clerk to City Council, H. F. Leonard.

Montreal, Que.

Council has voted $5,500 for Mentena St. sewer. Tenders will be called about March. Sec., L. N. Senecal.

Niagara Falls, Ont.

Ratepayers will vote on by-law January 5th, on storm water sewer to be constructed on Third Ave. and Maple St., at an estimated cost of $5,000. Clerk, W. J. Seymour. Engineer, F. J. Anderson.

Ottawa, Ont.

Surveys made for asphalt pavement, cost $35,000 to $40,000, on Osgoode St., from Nicholas to Range Rd. 3,800 ft. long on 6 in. concrete base, with gutters and headers. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

The city council contemplate re-paving Sussex St. between Rideau and St. Patrick, with asphalt and stone setts in track allowance. City Engineer, Arch. Currie, C.E.

Surface drainage having been completed, the city council have had the following surveys made for asphalt paving:—James St. from Bank to Bronson, $27,000; Lisgar St. from Bank to Bronson, $26,000. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

Owen Sound, Ont.

Ratepayers will be asked to vote on Roads by-law in January. Mayor, Mr. Lemon. Clerk, Chas Gordon.

Port Robinson, Ont.

Cement sidewalks planned by Thorold Twp. Council. Clerk, Major Donald Sharpe, Thorold. Engineer-in-charge, J. C. Gardner, Niagara Falls. Plans and specifications at office of Engineer. Tenders to be called shortly.

Richmond, Ont.

The village council are considering the expenditure of $3,000 on a macadam roadway between Bells Corners and Richmond. Further particulars from Councillor Chanonhouse.

Simcoe,Ont.

The Town Council has decided to call tenders about February 1st for lateral sewers and house connections. Clerk, W. C. McCall.

St. John, N.B.

The following permanent pavements are contemplated by city council. Main, Garden St., Chipman Hill, Orange, Princess Charlotte, Union, Horsefield and Market Sq. Commr., Miles Agar.

Toronto, Ont.

The Commissioner recommends walks on Arlington, Chandos, Conduit, Caledonia, Dartford, Greenlaw, Indian Road, Monarch, McRoberts and Toronto, which has been approved. The estimated cost is $6,312. Commr. of Works, R. C. Harris.

Plank roadway is contemplated by Board of Control, on St. Clair Ave., between McRoberts Ave. and G. T. R. tracks, also on Mt. Pleasant Rd. from Soudan to Victoria Ave. Commr. of Works, R. C. Harris.

The following grading has been approved by Commr. of Works. 940 ft. on Indian Grove, $5,914; 3,424 ft. on Queen, east of Beech, $12,296. Commr. of Works, R. C. Harris.

The following paving has been approved by Com. on Works. Brick block on Wilton Cres., $2,825; asphalt on Gladstone, $11,112; bitulithic on Teddington Park Blvd., $26,470; bitulithic on Brock. $4,731. Commr. of Works., R. C. Harris.

Whitby, Ont.

A sewerage system is contemplated by Town Council. Clerk, Jos. White. Engineer, T. Aird Murray, Lumsden Bldg., Toronto. Plans and estimates will be presented to citizens shortly.

Wingham, Ont.

8-in. sewers are contemplated by town council, in Victoria St., Diagonal Road, Francess St. and Shuter St. Clerk, John F. Groves.

Winnipeg, Man.

Pump house, cost $2,429.30, at Well No. 25, planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction.

Sewer and watermain planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, D. Kuxhaus, 654 College Ave., for sewer in Louise St., at $941. General contractor, J. W. Astley, Supt. of Construction, for water main in Richard Ave. at $152.05.

By-law providing for park improvements at an estimated cost of $110,000 was defeated by ratepayers Dec. 12th. Sec. Board of Control, M. Peterson.

C. I. water pipe required by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. 50,000 ft. of 6 in. pipe; 12,000 ft. of 10 in. pipe; 6,000 ft. of 8 in. pipe; 3,000 ft. of 12 in. pipe. Specifications at office of Engineer. Tenders received by Board until Jan. 2, 1914.

Yarmouth, N.S.

Sewerage system, cost $107,888.27, planned by town council. Mayor, S. C. Hood. Clerk, Hiram Goudey. Engineer-in-charge, E. S. Matheson. Plans drawn.

CONTRACTS AWARDED

Regina, Sask.

Sewage disposal works, cost $3,800.39, planned by City of Regina. City Commr., L. A. Thornton. City Engineer, F. McArthur. Steel roof for filter bed, awarded to Hamilton Bridge Works Co., Ltd., Barton and Bay Sts., Hamilton, Ont. Additional contract awarded.

Toronto, Ont.

Sewers planned by Board of Control. General contractors, Godson Contracting Co., Manning Chambers. Quebec Ave. to Runnymede, $34,730; Woodbine Ave. from Kingston Rd. north, $61,730. General entractors, J. H. McKnight Contracting Co., 88 St. David St., Danforth Ave from Hillington to Woodbine, $28,945.

Sewer, cost $3,148, planned by York Twp. Council. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide E. General contractors, Routly & Summers, Benamond Ave. Sewer on Kennedy and Barrie Ave. Contract awarded but subject to approval City Engineer.

Railroads, Bridges and Wharves

Province of Alberta

Edmonton, Durwegan & B. C. Rly. have been authorized to construct bridge across Athabasca River, Mileage 131, west of Edmonton.

Broadacres, Sask.

Location of C. P. R. station at Broadacres on S.W. ¼ Sec. 32-35-21, W.3.M., has been approved.

Cobalt, Ont.

Dam, etc., contemplated by Cobalt Lake Mining Co. Sec.-treas., G. F. Morrison, 418-20 Traders Bank Bldg., Toronto, Ont. Company has made application to drain Cobalt Lake into Farr Creek. Dam pipe line flues and pumping machinery will be required.

Coniston, Ont.

Location of C. N. O. Rly. station at Coniston, Twp. Neelon, Dist. Nipissing at mileage 257 from Toronto has been approved.

Edmonton, Alta.

Bridge, over Sask. River, planned by City of Edmonton. Mayor, Mr. Short. Civic Offices. Clerk, C. Cox, Civic Offices. City Engineer, A. Latornell, Civic Office. Lyall Mitchell Constr. Co., 389 Main St., Winnipeg, is the general contractor for this work.

Fitzroy Twp., Ont.

Ratepayers will be asked to vote on by-law Jan. 5th to raise the sum of $20,000 for erection of 2 bridges over the Mississippi River in the above Twp. Clerk, Alex. Murphy, Antrim, Ont. Engineer-in-charge, David Barry, C.E., c/o Clerk.

Granby Bay, B.C.
Plans are filed with Registrar of Deeds for a wharf which is contemplated by Granby Consolidated Mining & Smelting & Power Co., Ltd. General Manager, T. M. Sylvester, 509 Richards St., Vancouver, B.C.

Kingsbury, Que. (Near)
C. P. Rly. have been authorized to construct bridge No. 49.8, over Salmon River, Orford Sub. Div.

Lambeth, Ont.
Surveys made for 2 bridges, cost $1,600, between Lambeth and Delaware, each 1 span, 20 ft. long, reinforced concrete. Clerk to County of Middlesex, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London.

Twp. of Metcalfe, Ont.
Surveys made for bridge, cost $2,300, 3 spans, 10 ft. long, reinforced concrete and steel. Clerk to Twp. Council, Richard Ward, Strathroy. Tenders to be called after the New Year.

County of Middlesex, Ont.
Surveys made for bridges, cost $1,400, between Lobo and London Twps. and between London and Biddulph Twps. Each 1 span, 20 ft. long, reinforced concrete. Clerk to County Council, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London. Tenders to be called after the New Year.

Montreal, Que.
Shed, Lachine Canal, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Architect, Mr. E. Marceau, Supt. Engineer, New Birks Bldg. Tenders will be called about Feb. 1st for corrugated galvanized iron sides and rolling gates for St. Gabriel shed No. 1, Ottawa St., Montreal, Lachine Canal.

C. P. Rly. have been authorized to construct bridge No. 2.0, Montreal Terminals, Eastern Div.

Nassau, Ont.
Dredging required by Canadian General Elec. Co., Peterboro. Consulting Engineer, Henry Holgate, Richelieu Bldg., Montreal. Plans at office of company in Peterboro and Toronto, and office of Engineer. Tenders received until Dec. 31 for excavation and dredging tail race for power plant, about 24,000 cubic yards.

Prov. of Ontario
Four bridges, cost $90,469, Abitibi District, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Canadian Bridge Co., Ltd., Walkerville, Ont. Piers and abutments completed. Steel work will not be erected until spring.

Parkhill, Ont.
Bridge, over Mud Creek, cost $1,400, planned by County of Middlesex. Clerk, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London. Tenders to be called after the New Year. One span, 20 ft. long, concrete and steel.

Two bridges, over Mud Creek, cost $5,000, planned by County of Middlesex. Each 1 span, 60 ft. long, concrete and steel. Clerk, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London. Tenders to be called after the New Year. Plans and specifications at office of Engineer.

Toronto, Ont. (York)
The G. T. Rly. will be petitioned by residents to build a new station building.

Toronto, Ont.
Bridge, Cherry St., planned by Toronto Harbor Commission. Sec., A. C. Lewis, 76 Adelaide W. Plans approved for scissor type lift bridge, 86 ft. span. Contracts not yet awarded.

$142,000 will be included in estimates for reconstruction of Dundas St. bridges. Commr. of Works, R. C. Harris.

CONTRACTS AWARDED

Coniston, Ont.
Railroad construction, cost $20,000, for Mond Nickel Co. Chief Engineer, Mr. Dotloff. General contractors, Nipegon Constr. Co., Nipegon, Ont. Six miles 80 lb. rail standard gauge.

Sussex, N.B.
Station planned by Dom. Govt. Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General contractors, British America Constr. Co., Ltd., St. John. Plumbing and heating, Carland & Regan, Princess St., St. John, N.B. Stone and brick construction.

Richmond County, N.B.
Bridge planned by County Council. General contractors, The Standard Construction Co., Ltd., Metropole Bldg., 193 Hollis St., Halifax, N.S. Geo. T. McNutt, D. W. B. Reid, Jas. E. Gould and Roy A. Smith. Bridge to be built from mainland to Burnt Islands, thence to Madame Island. To consist of 9 cement piers faced with granite and will have a draw in the centre for passage of vessels.

Public Buildings, Churches, Schools, etc.

Brampton, Ont.
Negotiations have been opened by the St. Michaels Hospital Board re establishing a branch in Brampton. Archbishop, N. McNeil, Wellesley Place, Toronto.

Brussels, Ont.
Church, cost $20,000, for Melville Pres. Church. Pastor, Rev. A. J. Mann. Architect, J. S. Russell, 21 Downie St., Stratford. Chairman Com., J. Leckie. Sec. Com., Malcolm Black. Tenders received by Sec. until Jan. 8th for erection of new church and stables. Plans, etc., at Fox's Drug Store, Brussels.

Gravenhurst, Ont.
Plans are in progress for a recreation hall in connection with the Muskoka Free Sanitarium. Architects, C. S. Cobb and F. A. Spangenberg, 71 Bay St., Toronto, Ont. Two storeys, frame and stone construction, steam heating, metal casement sash. Cost is estimated at $10,000.

Hamilton, Ont.
Alterations and addition to school planned by Board of Education. Sec., R. H. Foster. Architects, Stewart & Witton, H. P. & L. Bldg. Tenders received by Sec. until 5 p.m. Dec. 24th. Plans and specifications at office of Architects. Alterations and addition to Queen Victoria School.

Hespeler, Ont.
By-law for providing $25,000 for the erection of Town Hall will shortly be submitted. Clerk to Town Council, Winfield Brewster.

Kitsumgallum, B.C.
Large one-room school planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. Engineer, J. E. Griffith, Victoria. Tenders received by Minister until noon Dec. 29th. Plans, etc., at office of J. H. McMulin, Govt. Agent, Prince Rupert, S. H. Hoskins, Govt. Agent, Hazelton, W. J. Goodwin, Sec. School Board, Kitsumgallum, and at Dept. Public Works, Victoria.

London, Ont.
The Com. of Board of Education (Chairman E. R. Dennis) have recommended that the McCormick property on Grand Ave., be purchased for school purposes. Building to be remodelled and school furnishings purchased.

Matsqui, B.C.
School (4 rooms) planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. Engineer, J. E. Griffith, Victoria. Tenders received by Minister until noon Dec. 30th. Plans, etc., at office of Wm. Merryfield, Sec. School Board, Mount Lehman, F. C. Campbell, Govt. Agent, New Westminster, and Dept. Public Works, Victoria.

Millbrook, Ont.
A site has been purchased by the Dominion Govt., Dept. of Public Works, for the erection of a Post Office building. Secretary, R. C. Desrochers, Ottawa.

The Library Board of the Village Council, through their clerk, W. S. Given, has applied for a grant from the Carnegie Trust.

Montreal, Que.
A proposal is on foot for the erection of a Synagogue with a seating capacity of 1,000 at Mt. Royal and Mance streets, and a committee is applying to Legislature for incorporation at next session.

Province of New Brunswick
The Intercolonial Railway contemplate the erection of a bridge over the Miramichi River between Chelmsford and Millerton. General manager, F. Gutelius, Moncton.

Port Arthur, Ont.
A new church will probably be erected by St. John's Anglican Church. Bertram Grosvenor Goodhue, New York, N.Y., is spoken of as the architect.

Regina, Sask.
Nurses Home, $75,000, planned by City Council (Hospital Board). City Commissioner, L. A. Thornton. Architects, Reilly, Dawson & Reilly, 512 Westmount Chambers. Brick foundation and construction, electric lighting. Plans in progress.

Police station planned by City of Regina (Police Commission). Architects, Clemesha & Partnell, 1721 Scarth St. Com. appointed:—L. A. Thornton and Chief of Police Yeats, to work out details in plans before tenders are called. Work to start in spring.

Church, cost $50,000, 7th Ave. and Garnet. Owner, St. Chads Congregation. Architect, J. H. Putin, 308 Darke Block. Seating capacity 600, plans are in progress, and work will start in spring.

Saskatoon, Sask.

Hospital, cost $500,000, planned by Saskatoon Hospital Board. Sec., Jno. Ryan. Architects, Brown & Vallance, 1006 McArthur Bldg., Winnipeg. Representative Architect, Allan McLean, Willoughby Sumner Block. Heating and ventilating, Jas. Maalleer, 343 S. Dearborne St., Chicago, Ill. Work has been postponed, but may go on next year.

Swift Current, Sask.

School, $125,000, planned by Public School Board. Ses.-Treas., J. T. Dodds. Foundations completed, but the Board has decided to wait until early spring before calling tenders for construction.

Sudbury, Ont.

Post office, Elm, cost $99,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Doran & Devlin, Sudbury or Eastern Blk., Ottawa. Three storeys, 80 x 60, steel, stone and terra cotta construction. Work postponed until spring.

St. John, N.B.

Tuberculosis hospital, Merrit, planned by Board of Hospital Commrs. Chairman, H. B. Schofield, City Hall. Architect, F. Neil Brodie, 42 Princess Street. Tenders to be called in spring. Plans in progress.

St. Thomas, Ont.

Y. M. C. A., cost $50,000. Architect, John Findlay. General contractor, A. E. Ponsford, 605 Talbot St. Sub. tenders close with Architect Dec. 27th.

Vancouver, B.C.

Hastings Council authorized by-law providing $10,000 for the erection of a fire hall in 1914. Clerk, Wm. McQueen.

Welland Jct., Ont.

The Welland Jct. Public School Board (C. W. Nugent, Welland Jct.), propose erecting a new school building at an estimated cost of $14,000. Four rooms, brick construction, school furniture and supplies required.

Winnipeg, Man.

University planned by Prov. Govt. of Manitoba. Minister, Hon. W. H. Montague. Prov. Architect, W. Harwood, 261 Fort Street. Consulting architects, Brown & Vallance, McArthur Building. Working plans and specifications will be ready about April, 1914. Three storeys, 200 x 75.

By-law providing for public lavatories at an estimated cost of $50,000 passed by ratepayers Dec. 12th. Sec., M. Peterson.

Suburban fire stations. By-law passed by ratepayers Dec. 12th. Sec., M. Peterson.

By-law providing for isolation hospital at an estimated cost of $100,000, passed by ratepayers Dec. 12th. Sec., M. Peterson.

CONTRACTS AWARDED

Lakefield, Ont.

Post office, etc., planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Jas. Bogue, 220 Dublin St., Peterboro. Two storeys, basement and tower, brick and stone construction, structural steel.

Montreal, Que.

School, Poupart St., for R. C. Board of School Commrs. Sec., U. Lafontaine, 92 St. Catherine W . Architects, Venne & Labelle, 5 Beaver Hall Sq. General contractors, O. Filton & Sons, 869 De St. Valier. Heating and plumbing, W. J. McGuire & Co., Ltd., 332 Craig St. Additional contract awarded.

Toronto, Ont.

School, Western, planned by Board of Education. Sec., W. C. Wilkinson. Additional contract awarded. Iron stairs, Shipway Iron Bell & Wire Mfg. Co., 773 King W., $2,370.

School, Regal Rd., planned by Board of Education. Sec., W. C. Wilkinson. Additional contracts awarded. Plumbing, John Ritchie Co., 56 Adelaide E., $6,160. Heating and ventilating, Fred Armstrong Co., Queen W., $12,595. Heat regulators, Johnston Temperature Reg. Co., Adelaide W., $773. Wiring, Bennett & Wright, Queen E., $616.

School, Strathcona, planned by Board of Education. Sec., W. C. Wilkinson. Additional contract awarded. Iron stors, Shipway Iron Bell & Wire Mfg. Co., 773 King W., $990.

School, Howard, planned by Board of Education. Sec., W. C. Wilkinson. Additional contracts awarded. Steam heating, Fred Armstrong Co., Queen W., $4,062. Warm air heating, W. F. Rutley Heating & Ventilating Co., 36 Toronto St., $1,995. Heat regulators, National Regulator Co., 408 Lumsden Bldg., $675.

Business Buildings and Industrial Plants

Chatham, Ont.

The by-law providing for a bonus of $12,000 to the Saginaw Match Co., for the erection of a factory was defeated on Dec. 15th.

Edmonton, Alta.

Office building is contemplated by E. F. Hutchings, 112 Market St., Winnipeg. Architect not chosen yet. Nothing will be done until spring. Six storeys, brick construction.

Three stores, 1st, contemplated. Owner, architect and general contractor, C. Horne, 1700 24th St. Work to start about Jan. 1st. One storey, 50 x 75, brick construction, concrete foundation.

Englehart, Ont.

Addition to West & Jackson's sawmill will be made next spring to increase capacity.

Fort William, Ont.

Picture theatre, cost $25,000, Victoria, contemplated by Ben Ross, Corona Theatre. Seating capacity 1,000. Work to start in spring. Fireproof construction.

Goderich, Ont.

Planing mill, Maitland Rd., for Goderich Milling & Lumber Co. Architect, J. Ades Fowler. Tenders received by Co. One storey, 200 x 60, concrete and brick construction, cement foundation, felt and patent roofing (flat), dry kiln, 30 x 60, some machinery arranged for other lines required. Plans drawn.

Grimsby, Ont.

Theatre, $12,000, for A. W. Moore. Architect, Joseph Daw, 165 St. Paul St., St. Catharines. Two storeys, 50 x 150, brick construction, stone foundation, felt and gravel roofing, electric lighting, steam heating, maple floors, metal ceilings. Plans in progress.

Hamilton, Ont.

Theatre (moving picture or vaudeville) James St. N., for Princess Theatre. Manager, Geo. Swanick, 108 James N. Architects, Watt & Blackwell, Lister Chmbrs. Seating capacity 2,300. Building operations not likely to start until next summer. Plans in progress.

King St. E. store projected by owners and architects, Sparks & McKay, 133 Cannon St. E. Nothing will be done till next summer.

London, Ont.

The Fraser Hat & Cap Co., Carling St., contemplate an addition to their factory at an estimated cost of $5,000. One storey, 40 x 80, white brick construction, felt and gravel roofing, electric lighting, steam heating, pine floors, lime and sand plastering.

W. R. Vining, 269 Dundas St., has in mind the erection of an arena. Reinforced concrete construction, concrete foundation, felt and gravel roofing, electric lighting, concrete floors, wire glass, ventilators, metal sash, architectural iron railings and stairs, seating. Architect not appointed.

Montreal, Que.

Borden Milk Co., 108 Hudson Street, New York, contemplate the erection of a chain of stores in Montreal and will probably also build big distributing station.

Office building, cost $150,000, 153 St. James St., for National Trust Co., Ltd., 153 St. James St. Architect, K. G. Rea, 54a Beaver Hall Hill, who will call for General Contractor about Jan. 10th. Three storeys, 31 x 100, concrete foundation, waterproofed, stone, granite and brick construction, felt and gravel roofing, gas and electric lighting, steam heating, fireproof, maple, birch and concrete floors, hard wall plaster, marble, terrazzo and mosaic tiling, passenger elevator lifts, copper skylights, ventilators, fireproof doors and shutters, architectural iron railings and stairs, prismatic, plate and wire glass, revolving doors, bank fixtures, vaults, safes, weather strips, time recording clocks, vacuum cleaner, fire extinguishers, boilers, stocks, air compressors.

Nicolet, Que.

Ice house, cost $5,000, is contemplated by Borden Milk Co., 108 Hudson Street, New York, who will decide as to building at once as work has to be completed within two months.

Niagara Falls, Ont.

Chain factory contemplated by Dom. Chain Co., Ltd., Ellen Ave. Negotiations for site are being made. Will manufacture dredge chains as well as lighter lines.

Ormstown, Que.

Bottling warehouse, cost $10,000, is contemplated by Borden Milk Co., 108 Hudson St., New York. Work will probably start early in new year as owners want warehouse for spring.

Ottawa, Ont.
Factory, cost $14,000, for M. J. O'Brien, Aberdeen St. General contractor, A. E. Spooner, Windsor House. Electrical, H. L. Allan, 377 Somerset. Two storeys, solid brick construction. Additional contract awarded.

Peterboro, Ont.
Alterations to Royal Theatre. Manager, M. Geo. Clayton. Architect, Geo. M. Miller & Son, 93 Yonge St., Toronto. Alterations to increase seating capacity to 1,100. Sketches drawn.

Sketches are drawn for rennovation of and alterations to National Hotel (Mr. Geo. Graham). Architects, Geo. M. Miller & Son, 93 Yonge St., Toronto.

Pooles Resort, Ont.
Plans have been drawn for boat house, cost $6,185, for J. W. Butler, New York City. Architect, A. Stuart Allaster, Brockville, Ont. Two storeys, 40 x 65, frame construction, shingle roofing, electric lighting, maple and spruce floors, hard wall plastering, galvanized iron, screens.

Port McNicoll, Ont.
Two stores, cost $10,000, contemplated by Mr. Dan Robins, Victoria Harbor. Architect not yet chosen. Work will probably start in spring. Two storeys, brick construction.

Quebec, Que.
Pulp and paper mill, cost $4,000,000, is contemplated by Syndicate in which Col. B. A. Scott, 3 Genevieve Ave., Que., is interested. It is proposed to erect dam at Grande Descharge Rapids on the Saguenay River, for power to operate mill.

Regina, Sask.
Bank, cost $50,000, Lorne and 11th Ave., contemplated by Bank of British North America, Montreal. Manager, C. A. Cruik, Regina Branch. Site has been purchased.

Smithville, Ont.
Hardware and jewellery store, cost $5,000, contemplated by Murgatroyd Bros. Address inquiries to owner either before Jan. 15th or after April 15th. To be erected next spring or early in summer. Two storeys, 60 x 30, brick construction, stone foundation, gas and electric lighting.

H. Gracey contemplates erecting furniture store and undertaking establishment, to replace building recently destroyed by fire. Two storeys, stone foundation. Fixtures required at once for temporary quarters.

St. Catharines, Ont.
The Merchants Bank, Montreal, has purchased site on St. Paul St. and contemplate the erection of a branch thereon.

St. John, N.B.
The walls of Atlantic Sugar Refinery Co.'s new buildings, Balast Wharf, are about up. General contractor, E. G. M. Cape, New Birks Bldg., Montreal. Seven buildings, brick and steel construction.

Swift Current, Sask.
Plans are being prepared at an estimated cost of $12,000, for business block, Central Ave., for MacKenzie & Mann, (men's furnishings), 11th ave. Architect, G. A. Ferris. Two storeys, concrete foundation, concrete block construction, steel girders, tar and gravel roofing, electric lighting, steam heating, hardwood floors, hard wall plaster, encaustic tile, plate and wire glass, fire escapes, tile front entrance. Work to start in spring.

Toronto, Ont.
Warehouse, $36,000, for E. Pullan, 490 Adelaide St. W., who is open to receive tenders for carpentry, roofing, painting, heating, plumbing and electrical. Five storeys, 40 x 68, brick and mill construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, birch floors, wood lath, wire glass, galvanized iron, skylights, fireproof doors. Masonry, day labor. Plastering, none.

Alterations to storage, cost $7,000, for Bowes Produce Co., 76 Front St. E. Architect, L. J. Foulds, King St. and Leader Lane. Tenders will be called by architect after January 1st. Four storeys, steel and brick construction, concrete floors, galvanized iron, fireproof doors, fire escapes. Plans drawn.

Hotel, cost $125,000, contemplated by Jas. J. O'Neill, 53 Wellesley St. Architect, J. R. Hynes, 199 Yonge St. Board of License Commrs. have approved of site and have given permission to owner to erect building on N.E. corner of Bay and Richmond Sts. Three storeys, brick and steel construction.

Plans drawn for theatre, cost $5,000, for C. Letros, 228½ Yonge St. Architect and general contractor, T. P. Whitlam, 117 Summerhill Ave. Architect will superintend construction and let work. One storey, 24 x 120, brick and steel construction, brick foundation, felt and gravel roofing, electric lighting, hot water heating, maple floors, lime and sand and asbestos plastering, metal lath, store fronts and fixtures, seating.

Vernon, B.C.
Temporary additions will be made to the plant of Okanagan Steam Laundry Co. Concrete construction.

Victoria, B.C.
Departmental store, cost $1,250,000, Herald, Douglas & Fisguard, for The Hudson's Bay Company, Wharf Street. Manager, H. V. Pratt. Architects, Burke, Horwood & White, 28 Toronto St., Toronto, Ont. Tenders received by owners until December 27th for masonry, reinforced and plain concrete, architectural terra cotta, ornamental iron, carpentry and joinery, roofing and sheet metal, plastering, painting and glass, marble and tile. Plans, etc., at office of owners. Structural steel, reinforced concrete, granite, tile and brick construction.

Permit has been issued to F. Fairhurst, 1304 Queen St., for an addition of 35 rooms to hotel, at a cost of $20,000. Work to be done by day labor.

Plans are prepared for alterations to hotel at an estimated cost of $25,000, for H. H. Maloney, 1023 Government St. Architects, Coates & Fleet, Winch Bldg. Work to start shortly. Complete steam heating system to be installed.

Winnipeg, Man.
Hotel on William Ave., for E. J. Rochon, Leland Hotel. Architect, Mr. Hall, Chicago, Ill. Old building to be razed. New building to be erected next year. 100 x 88, brick and steel construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating, fireproof, oak and maple floors, hard wall plastering, mosaic tile, plate glass, passenger elevator, fire escapes, bar fittings, revolving doors, telephone system, vacuum cleaners, boilers, stacks. Plans prepared.

Store and office, Market St., for Lord Northcote, London, Eng. Two storeys and basement, cut stone front. Work to start in spring. Plans drawn.

Interior alterations to C. P. R. Co.'s office, cost $8,750, Portage and Main. Owners, Canadian Pacific Rly. Co. Architects, Engineering Dept. General contractors, C. W. Sharp & Sons. Plans drawn.

Weston, Ont.
Grand stand may be erected by York, Etobicoke & Weston Agricultural Society, near new race track now being laid out.

CONTRACTS AWARDED

Calgary, Alta.
Hotel, cost $65,000, 8th Ave. E. and 4th St., for Col. J. Walker. General contractor, Jones & Lyttle, 6th St. W. and Bow River. Steel, E. M. Huyck. Sheet Metal, D. R. Foulds, 1335 10th Ave. W. Sub contract awarded.

Montreal, Que.
Extension to jewellery factory, cost $30,000, 259 St. James St., for Estate Lyman, 259 St. James St. Two storeys, 83 x 29, brick construction. Architects, MacVicar & Heriot, 104 Union Ave. General contractor, Mr. Fromson, 68 Colonial Ave. Architects will award tenders for heating and plumbing shortly.

Residences

Brockville, Ont.
Residence, cost $5,000, Riverdale Ave., is contemplated by Arthur Stuart.

Dundas, Ont.
Four residences, cost $10,000, Alma, are contemplated by The Dickson Bldg. Co. Pres., J. W. Dickson. Site purchased. Two storeys, brick construction.

Edmonton, Alta.
Apartment block, 24th, is contemplated by C. Horne, 1700 24th St. Work to start about Jan. 1st. Three storeys, 50 x 150, brick construction, concrete foundation.

Hamilton, Ont.
Seymour Walker Co., Bank of Hamilton Bldg., contemplates erection on Garfield St., 5 residences, at an estimated cost of $12,000. 2½-storeys, brick construction, concrete and stone foundation, shingle roofing, gas and electric lighting, hot water heating, plumbing, hard wall plastering, wood lath, mantels.

Montreal, Que.
O. Lamoureux, 15 St. James St., has purchased a site on St. Catharine St., Westmount, and contemplates the erection of an apartment house.

Flats, cost $12,000, Durocher St., Outremont, for Mr. S. Paulhus, care architect, Mr. J. A. Ouellet, 250 Amherst. Tenders for general contract received by

(Continued on page 69)

Tenders and For Sale Department

City of Ottawa, Dominion of Canada

Tenders for Steel Pipes

Sealed tenders in duplicate addressed one copy to the City Clerk, City of Ottawa, Canada, and the other to Sir Alex. Binnie Son & Deacon, St. Stephens House, Westminster, London, Eng., and endorsed "Tenders for Steel Pipes," will be received until 4 p.m. on **Tuesday, the 3rd day of February, 1914**, for about forty-two miles of steel pipe, fifty-four inches internal diameter, about thirty-two miles of steel pipe fifty-eight inches internal diameter, and about eleven miles of steel pipe, fifty-one inches internal diameter.

Forms of tender and specification may be obtained from Sir Alex. Binnie Son & Deacon, St. Stephens House, Victoria Embankment, London S.W., or from the City Engineer of Ottawa, Canada, on and after the fifteenth on receipt by them of a cheque to the value of five hundred dollars made out to the City Treasurer of the City of Ottawa, Canada, which sum will be returned on receipt of a bona fide tender.

The lowest or any tender is not necessarily accepted.

No tenders will be considered except from actual manufacturers capable of supplying the whole of the pipes within a period of two and a half years from the date of acceptance of the tender.

SIR ALEX. BINNIE SON & DEACON,
Engineers in Chief,
St. Stephens House,
Westminster, London, Eng.
Dated December 4th, 1914. 51-52-53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dam on French River, South Channel, Ont.," will be received at this office until 4.00 p.m. on **Monday, December 29, 1913**, for the construction of a Dam across the South Channel of the French River, at head of Big Chaudiere Falls.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont.; Post Office Building, Montreal, and on application to the Postmaster at North Bay, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 5, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51842. 51-52

Tenders Wanted

Lump sum and separate tenders for the following trades: Mason and Bricklayer, Carpenter, Plumber, Plasterer, Painter and Glazier, Heating and Ventilation, Iron Stairs, Galvanized Iron, Hollow Tile, and Reinforced Concrete, Electric Wiring; for the erection of a new High School, will be received by the High School Board, Welland, up to 6 p.m., **January 10th, 1914**.

Address all tenders to Mr. Wm. H. Lowe, Secretary.

The lowest or any tender not necessarily accepted.

Plans and specifications may be received upon application to the Architect, D. F. Forbes, 43 Temple Building, Welland.

51-52

Sealed tenders addressed to the undersigned, and endorsed "Tender for Submarine Cables," will be received at this office until 4 p.m. on **Thursday, the 15th of January, 1914**, for 10 knots of gutta-percha cable with 4 conductors and 14 knots of gutta-percha cable with 2 conductors, to be delivered at Halifax, N.S., or St. John, N.B., by the 1st of May.

Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51974. 51-52

STEAM PUMPS

Sales agents for Canada are wanted by one of the world's largest manufacturers of steam pumps. Only firms with high class connection will be considered. Apply Box 924, Contract Record, Toronto. 51-53

Sealed tenders addressed to the undersigned, and endorsed "Tender for bridge substructure and approaches at North Timiskaming, P.Q.," will be received at this office until 4 p.m. on **Monday, January 12, 1914**, for the construction of the substructure and approaches of a highway Bridge at North Timiskaming, County of Pontiac, P.Q.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont., Post Office, Montreal, and on application to the Postmaster at North Timiskaming, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, he nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 19, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—52858. 52-53

FOR SALE

Steam Driven Air Compressors
thoroughly refitted

One 1,000′ Machine, Duplex Type, Compound Steam, Compound Air.
One 1,200′ Machine, Duplex Type, Compound Steam, Duplex Air.

For particulars and prices write

The Jenckes Machine Company
SHERBROOKE, QUE.
Montreal Office, - - - - - E. T. Bank Building

50-5

Tenders for Dredging

The undersigned will receive tenders up to **December 31st, 1913**, for excavation and dredging in the tail race of their Power Plant at Nassau, about six miles from Peterborough. The estimated amount of material to be removed is 24,000 cubic yards. Plans and specifications may be seen at the offices of the company, either at Toronto or Peterborough, or at the office of Henry Holgate, Consulting Engineer, Richelieu Building, Montreal. Lowest or any tender not necessarily accepted.

Canadian General Electric Company, Ltd.
52

Good Opportunity to Importers of Waste and Steels

Firms interested in above write
British Manufacturers' Association, Limited
803 McGill Building, Montreal

Representatives Wanted

Large firm manufacturing gravitation and pressure filters wants to secure reliable representatives for Canada. Successful installations in all parts of the world. Apply Box 923, Contract Record, Toronto. 51-53

Residences

(Continued from page 67)

architect until December 24th. Three storeys, 26 x 90, stone foundation, stone and brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, birch and pine floors, lime and sand plaster.

12 flats, Outremont (D'L'Epee Ave., cost $20,000. Owner and general contractor, G. Zudick, 829 St. Urbain St. Architect, A. Mendelsohn, 943 City Hall Ave. Work to start in a couple of weeks. Three storeys, 80 x 90, concrete foundation, brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, maple floors, lime and sand plaster. Plans in progress.

Three flats, cost $12,000, St. Denis, for A. Bleau, 190B Christopher Columbus. Three storeys, 50 x 35, concrete foundation, felt and gravel roofing. Permit issued.

Residence contemplated by J. Laurendeau, 30 St. James St., Montreal. Architect, R. Gariepy, 25 St. James St. Plans will probably be drawn this winter and tenders called in spring.

Montreal, Que., Outremont

A. St. Louis, 80 St. Gabriel. Architect will probably call for tenders about Feb. 15th for the erection of cottage at an estimated cost of $25,000. Three stys., 40 x 57, concrete foundation, waterproofed, brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, maple and birch floors, lime and sand plaster, plate and art glass, mantels, built in fireplaces, pool and billiard tables, marble tiling.

Residence contemplated by N. Belanger, 30 St. James St. Architect, R. Gariepy, 25 St. James St. Plans will probably be prepared this winter and tenders called in spring.

Regina, Sask.

Five-storey apartment building, 16th Ave., cost $30,000, for A. M. Fields, c/o W. A. Burns, New Dallas Block. Architects, Story & Van Egmond, 1 Credit Foncier Bldg. Nothing further will be done until next spring.

Sussex, N.B.

Residence contemplated by Geo. E. Fowler, Sussex. Probable architect, H. H. Mott, 13 Germain St., St. John.

St. John, N.B.

Apartments, Princess St., cost $15,000, for F. G. Spencer, c/o Unique Theatre. Architect, Garnet Wilson, 50 Princess St. Two storeys, brick construction, concrete foundation. Plans in progress.

Toronto, Ont.

One pair residences, cost $5,000, Carlaw Ave. Owner, general contractor and mason, Robert Oakley, 39 Wolfrey Ave. Two storeys, 36 x 42, brick construction, concrete and brick foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One pair residences, cost $5,000, Highfield. Owner and general contractor, I. Pigoan, 1335½ Queen St. E. Two stys., 34 x 42, brick construction, concrete foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, built-in fireplaces. Plans drawn.

Four duplex residences, cost $10,000, Beatty Ave. Architect, Henry Simpson, 82 King E. Two storeys, 72 x 80, brick construction and foundation, felt and gravel roofing, electric lighting, hot water heating, maple and birch floors, lime and sand plastering, mantels. Plans drawn.

Two detached residences, Ferndale Ave., cost $7,000. Owner and general contractor, Chas. Hough, 44 Ellsworth Ave. Owner superintends construction. Two storeys, 21 x 32, brick construction and foundation, shingle roofing, electric lighting, hot water heating, oak and birch floors, lime and sand plastering, built in fireplaces, mantels. Plans drawn.

One pair residences, Ashburnham, cost $5,000. Owners and general contractors, Coxworth & Galloway, 73 Harvie Ave. Owners superintend construction. 2½-storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Plans drawn.

Residence, Spadina Rd., cost $10,000. Owner and general contractor, J. E. Shaw, 381 Manning Ave. 2½-storeys, 36 x 42, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, marble tiling, mantels, built in fireplaces. Plans drawn.

Dominion Bank, Yonge and Colborne, contemplate erecting garage, Davenport and Avenue Rd. Commr. Chisholm recommends that permit be granted.

One detached residence, Joseph Ave., cost $5,000, for Dr. Dunlop, c/o General Contractors, T. H. Jones & Co., 310 Clinton St. 2½-storeys, 26 x 42, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in furnaces. Plans drawn.

One pair residences, McRoberts, cost $5,000, for F. A. Rode, 324 Symington Ave. Owner now receiving tenders on roofing, plastering, painting, drains, plumbing and electrical. 2½-storeys, 36 x 42.

One detached residence, Glen Rd., cost $12,500, for C. W. Defoe, 47 Simcoe. Architects, S. B. Coon & Son, Temple Bldg. Plans drawn, but tenders will not be called for until after Jan. 1st. Two storeys, 30 x 60, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in fireplaces.

Lodging house, Yorkville Ave., cost $35,000, for Wm. J. S. Tremaine, 171 Keele St. Architects, Cross Engineering Co., 165 Yonge St. Owner superintends construction. Will let plumbing and heating. Three storeys, 63 x 120, brick and steel construction, brick and concrete foundation, waterproofed, felt and gravel roofing, gas and electric lighting, steam heating, oak and maple floors, lime and sand plastering, metal lath, terrazzo tiling, skylights, fire escapes, pool or billiard tables. Plans drawn.

Three attached stores and residences, 954-58 St. Clair, cost $13,000. Owner and general contractor, Jethro Crang, 982 St. Clair Ave. Owner superintends construction. Three storeys, 54 x 64, brick construction and foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and maple floors, lime and sand plastering, mantels, built in fireplaces, store fronts and fixtures. Plans drawn.

One detached residence, Hogarth Ave., cost $6,000, for Geo. Gayton, 2 Wayland Ave. Architect, H. Salisbury, 17 Bowden. Owner will sublet some trades. 2½-storeys, 24 x 49, brick construction and foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

One detached residence, Lauder Ave., cost $5,000, for H. S. Gansby, 36 Highview Ave. Two storeys, 25 x 30, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Apartment, Christie, cost $8,000, for J. G. Hedges, 210 Clinton St. Two storeys, 36 x 48, brick construction and foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in firepalces, mantels. Plans drawn.

Wm. Horwood, 491 Concord Ave., has purchased a site on St. Clair Ave., and contemplates erecting a brick residence thereon.

Residence, Glenholm, is contemplated by Thos. Robinson, 1310 Lansdowne Ave. Site purchased, 37 ft. frontage.

Alterations to apartment, 126 Garden Ave., cost $5,000, for F. H. Ross & Co., Lumsden Bldg. Contract not yet awarded. Two storeys, brick construction, gas and electric lighting, hot water heating, birch and oak floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Winnipeg, Man.
Apartment Block, Jessie and Helen, for J. A. Patterson, 664 Carydon Ave. Architects, Ross & McDonald, 928 Union Bank Bldg. Pressed brick construction, stone foundation, felt and gravel roofing, electric lighting, steam heating, oak and maple floors, hard wall plastering. Plans in progress.

CONTRACTS AWARDED

Regina, Sask.
Residence, Lorne, cost $5,000, for Geo. Middleton, 2169 McIntyre St. General contractors, Johnson & Mills, 101 Westman Chmbrs. 2½-storeys, brick and frame construction, concrete foundation, shingle roofing, electric lighting, hot air heating, maple floors.

Ottawa, Ont.
Residence, cost $7,000, Wurtemburg. Owner and general contractor, J. P. MacLaren, 104 Sparks Street. Iron and tinsmith, J. E. Sheppard, 261 Albert. Painting, J. H. Baron, 420 Gladstone. Two and one-half storeys, brick veneer construction. Additional contract awarded.

Toronto, Ont.
Residence, Park Place, cost $6,000, for L. J. Richardson, 415 Dovercourt Road. Architects, Symons & Rae, Home Life Bldg. Mason, Wm. Edwards, 281 Howland Ave. Carpenter, G. L. Robinson, 107 Armstrong Ave. Tenders in for other trades, but not yet awarded. 2½-storeys, brick construction and foundation, slate roofing, gas and electric lighting, hot water heating, oak, concrete and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels.

Power Plants, Electricity and Telephones

Blenheim, Ont.
Town Council require additional tanks and piping for fire protection purposes. Clerk, Geo. W. Riseborough. Reeve, A. Denholm.

Montreal, Que.
Tenders received by Board of Commissioners until noon, December 30th, for lighting fixtures for City Hall Annex. Specifications, etc., at office of Superintendent of Lighting Department, City Hall.

Power house equipment required by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Engineer, Mr. E. Marceau, New Birks Bldg., Montreal. Two turbine wheels, 60 in. diameter; 2 electric generators; 2 transformers. Tenders to be called shortly.

Electric and gas fixtures, cost $9,000, required by Board of Commrs. Sec., L. N. Senecal, will probably call tenders.

Ottawa, Ont.
Ottawa Light, Heat & Power Co. will use $700,000 new capital for construction of gas mains and general development. President, F. Ahearn. Superintendent, A. Dun, Sparks Street.

Winnipeg, Man.
Copper wire, $7,532, required by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractor, E. F. Phillips, Electrical Works, Ltd., 602 Electric Ry. Chambers. Incinerator by-law, $85,00, defeated by ratepayers Dec. 12th. Sec., M. Peterson.

Transformers required by Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St. For supply of pole type and subway transformers during year 1913-14. Specifications at office of Engineer. Tenders received by Board until Jan. 5th .

By-law passed by ratepayers Dec. 12, providing for the installation of power plant at an estimated cost of $1,000,000. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Yarmouth, N.S.
A committee of the Board of Trade has been appointed to look into the matter of erecting a cold storage plant for the preservation of fresh fish specially, also a medium sized artificial ice plant.

CONTRACTS AWARDED

Regina, Sask.
Power house equipment required by City Council (Light and Power Dept.). Supt., E. W. Bull. Contract for asbestos covering for steam pipes awarded to H. W. Johns-Manville Co., Ltd., 92 Arthur St., at $1,362.32.

Miscellaneous

Brussels, Ont.
George Edwards requires castings to be used in manufacturing new ditching machine.

London, Ont.
Bank of Toronto, Manager, John Pringle, will probably be purchasing fire escapes.

Newmarket, Ont.
Town Council has decided to install water meters on premises of all consumers. Clerk, J. E. Hughes.

Ottawa, Ont.
Foley & Gleeson, Central Chambers, contemplate purchasing portable asphalt mixer.

Ventilating system contemplated by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Estimates for 1914 include ventilating system for Printing Bureau.

Smithville, Ont.
Village Council contemplates the purchase of a number of chemical fire extinguishers and hose for fire engine, 6-in. suction pipe and quantity of reel hose, 4-in. Sec. Board of Trade. F. H. Patterson.

Sudbury, Ont.
Hospital fittings required by St. Joseph's R. C. Church. General contractor, J. B. Laberge.

Sydney, C.B.
Dom. Iron & Steel Co. intend to install new heating furnace in rolling mill, will also install new tables.

St. John, N.B.
New Brunswick Cold Storage Co. will receive tenders for waterproofing cellar. Manager, H. R. Ross, 33 Wright St. Engineer, Geo. Wetmore, C. P. R. Bldg., King St.

Winnipeg, Man.
Ice fender required by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Ice breaker and fender for Louise bridge. Specifications, etc., at office of Engineer. Tenders received by Board until Dec. 26th.

New Companies

J. R. Baxter & Co., Ltd., has been incorporated with a capital of $75,000, to carry on business as manufacturers of builders materials, etc., with head office at Montreal. The provisional directors are J. R. Baxter, merchant, W. J. W. Booth, manager, T. R. Eeland, traveller, H. Warfield and P. Ledien, advocates, all of Montreal.

Richmond Construction Co., Ltd., has been incorporated with a capital of $100,000, to carry on business as builders and contractors, with head office at Montreal. The provisional directors are P. Bercovitch, W. P. Kearney, E. Lafontaine, advocates, J. Johnston and J. O'Reilly, accountants, all of Montreal.

Brick & Construction Products Company of Montreal, Ltd., has been incorporated with a capital of $600,000, to carry on business as general contractors, with head office at Montreal. The provisional directors are R. Taschereau, K.C., Thibaudeau Rinfret, K.C., N. Z. Cordeau, deputy prothonotary, and A. R. W. Plimsoll, advocate, all of Montreal.

Transcontinental Construction Co., Ltd., has been incorporated with a capital of $50,000, to carry on business as general contractors, with head office at Montreal. The provisional directors are W. J. White, K.C., and A. W. P. Buchanan, K.C., and T. S. Owen, advocate, all of Montreal.

D. Morton Co., Ltd., has been incorporated with a capital of $20,000, to carry on business as timber merchants, sawmill owners, etc., with head office at Victoria, B.C.

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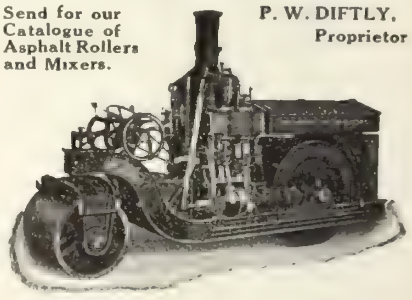

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Manufacturers of
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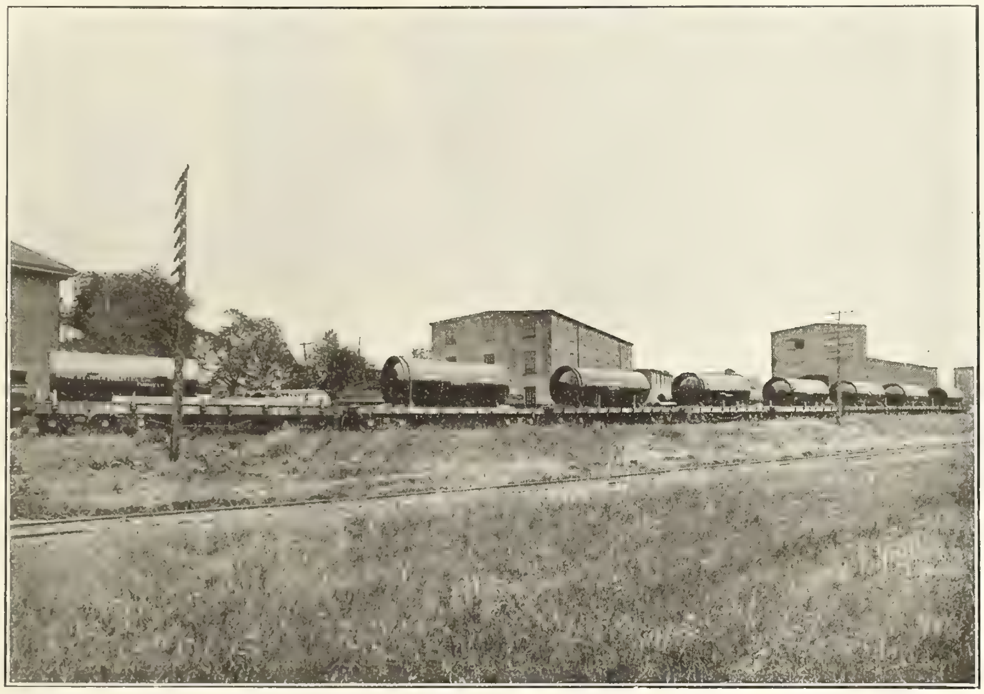

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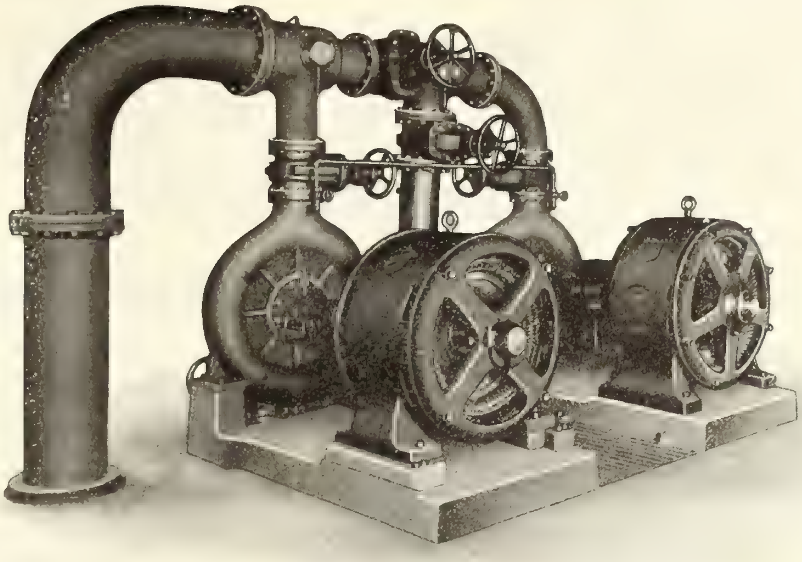

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Ford Motor Co. of Canada, Limited

In 1910 we built a three story reinforced concrete factory building for these people at Walkerville, Ont. Since that time our men have never been off the job. We have built two large extensions to main factory building, a large fireproof office building, an engine house, gas producer building, heat treatment building with two large extensions, amounting in all to $450,000.00.

Swift Canadian Co., Limited

In 1911 we built a Concrete building for the Union Stock Yards Co., (an allied firm) at West Toronto, since then for the Swift people at West Toronto we have built a large Reinforced Concrete Fertilizer Building, a nine story Reinforced Concrete Cold Storage Building and three smaller buildings amounting in all to $275,000.00.

Hiram Walker & Sons

Three years ago we built a Reinforced Concrete Power Building for Walker Sons, at Walkerville, Ont., since then we have built a large four story extension to this building and also three other extensions to this building for the Peabody Co., Limited and the Leather Label Overhaul Co., in which building the Walkers were interested. So that now we have a whole block of Reinforced Concrete buildings 3 and 4 storeys in height covering about 30,000 square feet of land and worth $95,000.00.

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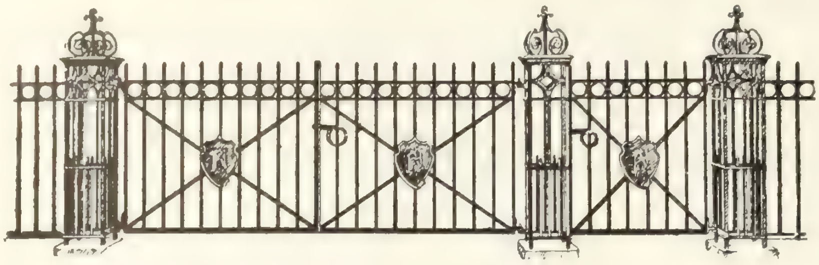

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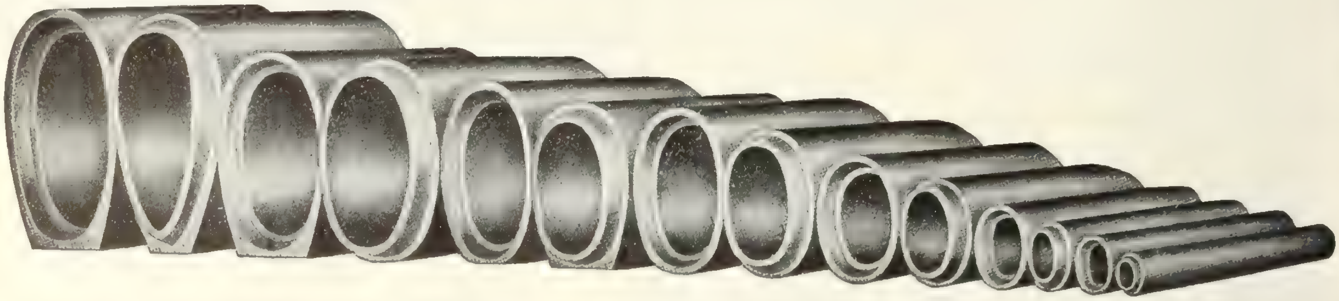

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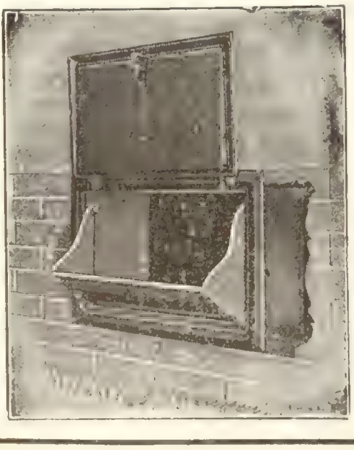

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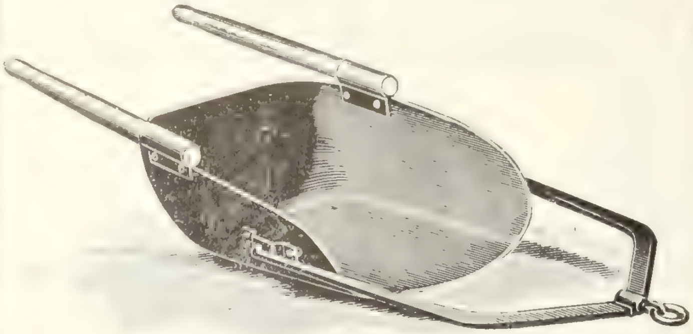

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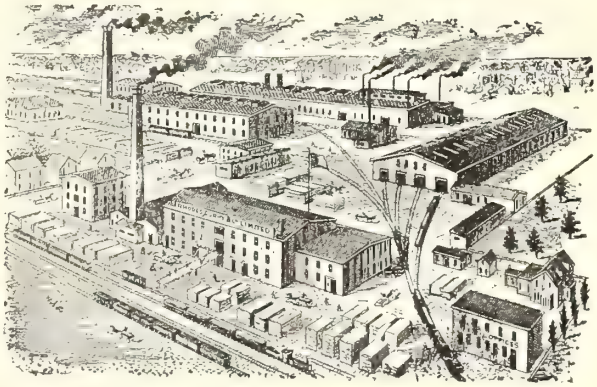

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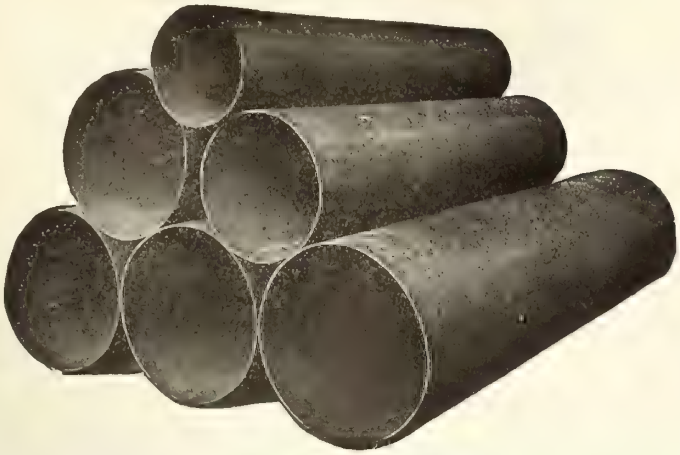

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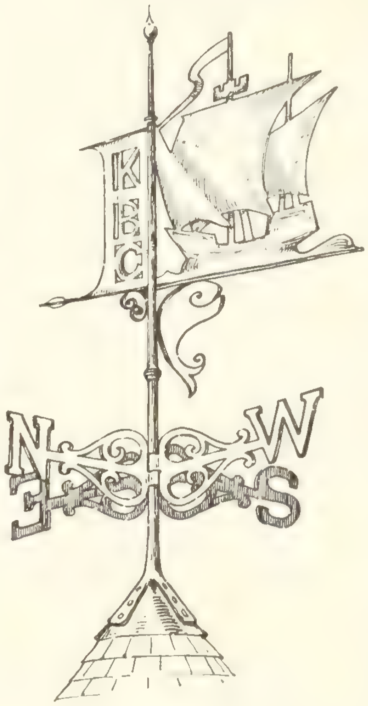

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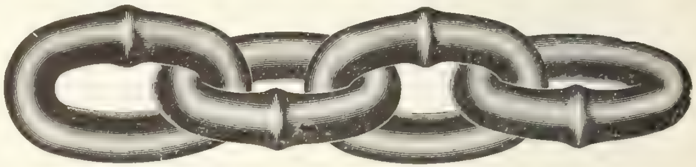

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Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
Breaking Test	26,000 lbs.	36,000 lbs.
Working Load	8,000 lbs.	11,000 lbs.

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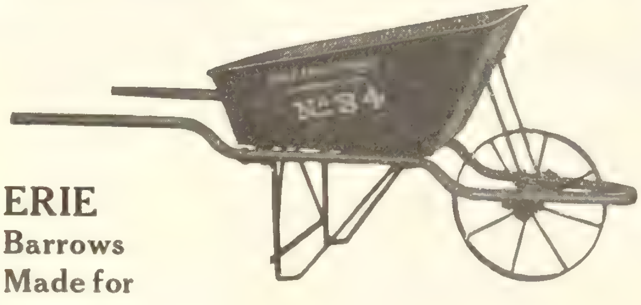

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Absolutely the best in the city.
Daily capacity of plant: 40,000.
Uniform in size, color and quality.
Free from bats and culls.
High crushing test.

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Towers and Tanks for all purposes.

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Thousands and thousands of gallons of this coating are being used as a protection for cement, brick and stucco in the Canadian Northwest.

It insures concrete, cement and stucco against disintegration from moisture and does not destroy the pleasing effect of concrete.

It is used in mills, hotels, residences, rail road construction, or bridges, or wherever concrete, cement or stucco is employed.

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White Oak Timbers

We Offer for Sale from Stock Here the Following Lot of A-1 Grade Oak Timber

Length	Size	Length	Size	Length	Size	Length	Size
60 ft.	12 in. x 15 in.	23 ft.	13 in. x 14 in.	52 ft.	13 in. x 14 in.	38 ft.	12 in. x 14 in.
41 ft.	18 in. x 20 in.	33 ft.	15 in. x 15 in.	51 ft.	18 in. x 19 in.	31 ft.	13 in. x 13 in.
40 ft.	19 in. x 20 in.	43 ft.	18 in. x 19 in.	48 ft.	15 in. x 16 in.	31 ft.	14 in. x 16 in.
32 ft.	12 in. x 15 in.	60 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.	35 ft.	14 in. x 15 in.
24 ft.	15 in. x 16 in.	44 ft.	18 in. x 18 in.	43 ft.	18 in. x 19 in.	39 ft.	18 in. x 18 in.
34 ft.	12 in. x 14 in.	43 ft.	16 in. x 16 in.	34 ft.	13 in. x 13 in.	41 ft.	17 in. x 18 in.
25 ft.	14 in. x 14 in.	38 ft.	13 in. x 15 in.	30 ft.	14 in. x 15 in.	42 ft.	16 in. x 18 in.
28 ft.	14 in. x 13 in.	41 ft.	12 in. x 13 in.	21 ft.	15 in. x 16 in.	41 ft.	14 in. x 15 in.
32 ft.	12 in. x 14 in.	37 ft.	13 in. x 14 in.	23 ft.	19 in. x 20 in.	38 ft.	13 in. x 14 in.
28 ft.	16 in. x 16 in.	43 ft.	16 in. x 16 in.	29 ft.	17 in. x 19 in.	27 ft.	14 in. x 17 in.
29 ft.	16 in. x 16 in.	47 ft.	16 in. x 17 in.	34 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.
31 ft.	14 in. x 13 in.	43 ft.	15 in. x 16 in.	35 ft.	14 in. x 17 in.	40 ft.	13 in. x 13 in.
33 ft.	13 in. x 14 in.	39 ft.	14 in. x 14 in.	35 ft.	15 in. x 15 in.	41 ft.	13 in. x 14 in.
33 ft.	13 in. x 14 in.	41 ft.	13 in. x 15 in.	31 ft.	12 in. x 13 in.	39 ft.	13 in. x 13 in.

60 Foot Piles on Hand. **Our Mill Runs all Winter.**

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MANUFACTURERS OF

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For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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Bridges—Steel Buildings
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GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

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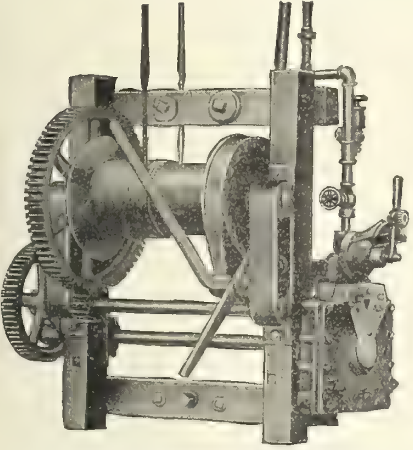

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as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

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Contractors who buy numbers of Hoists usually have to be convinced that what they are getting is "O. K."

The closer they examine and watch Beatty Hoists under severest conditions — the better pleased they are.

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Will gladly send full particulars and catalog.

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All carry our equipment in stock.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock	net$1.85
No. 4½ Fuller's	net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

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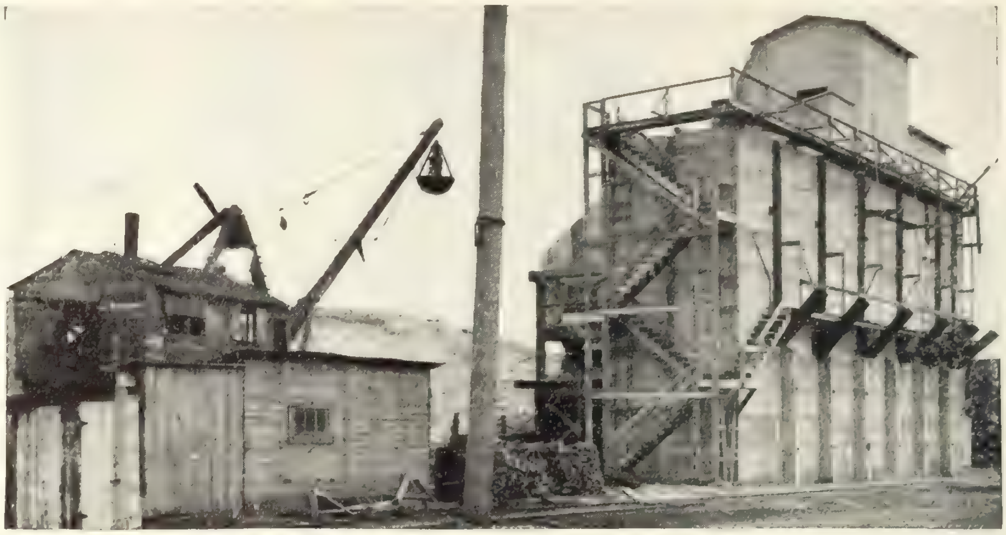
Sand and Gravel Washing Outfits



We have perfected every device necessary for an up-to-date sand and gravel washing outfit and have a staff of competent engineers who can design and erect a plant of any capacity.

The illustration shows a "Dull" designed and equipped plant in successful operation in Grand Rapids, Mich. There are many such plants in operation in every part of the country.

We would like you to have our catalogue. It is sure to contain some equipment that would mean dollars to you if installed in your plant.

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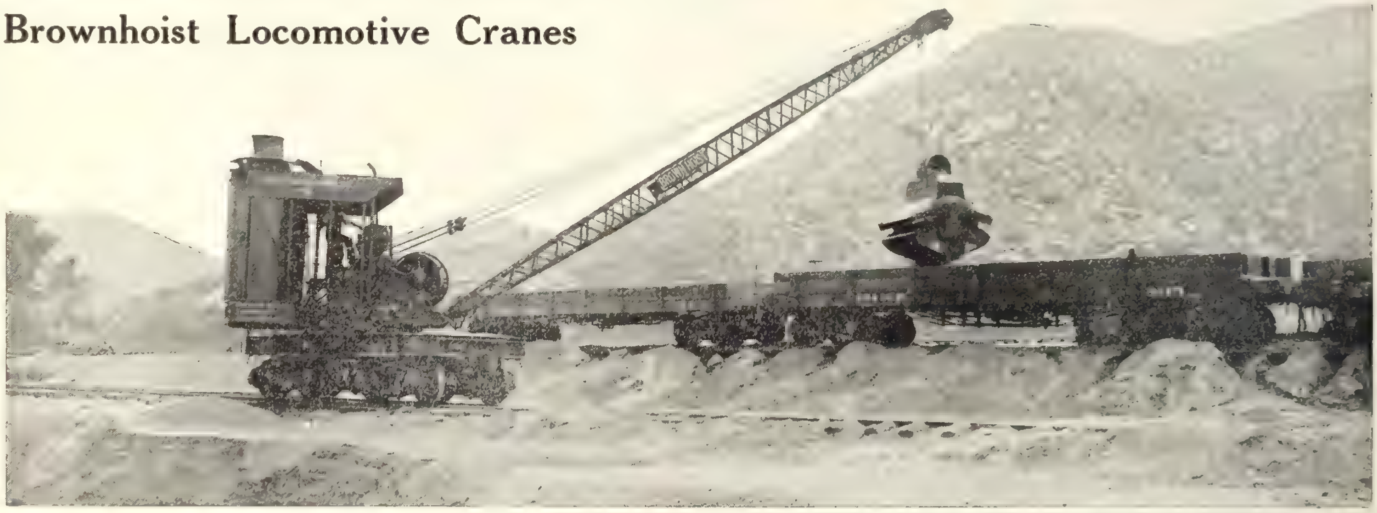
The Raymond W. Dull Co., 719 Chamber of Commerce Bldg., Chicago, Ill.

Brownhoist Locomotive Cranes



15-Ton Brownhoist Locomotive Crane used by the Independent Stone Co., San Diego, Calif.

If you handle stone, gravel, sand, coal, etc., you should investigate the use of Brownhoist Locomotive cranes for your work. Each crane, equipped with a Brownhoist Patent Grab Bucket, handles these materials 1 to 2 tons at a load, from and to stock pile, cars, boats, wagons and bins. And the crane also does the switching of the cars.

These cranes are being used in all sections of the country and you should investigate their operations.

Write for our new catalog K which shows how and where these cranes are being used.

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of all types and sizes, Heaters, Tanks, Pumps, etc.

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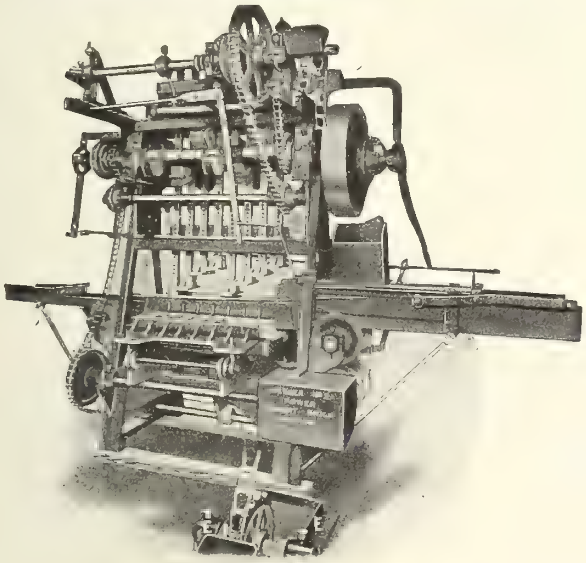
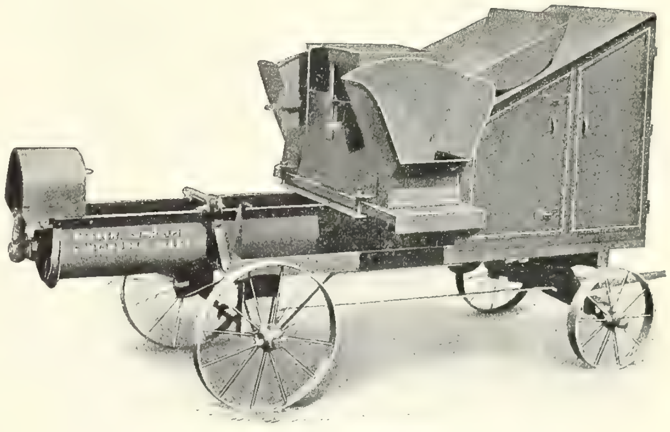
Here are the two Besser machines that make the best cement brick on the market. The Brick machine that will make 30,000 bricks per day—every brick the same.



Besser Power Cement Brick Machine



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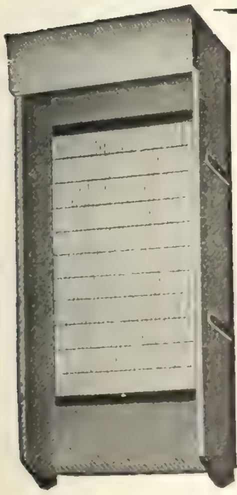

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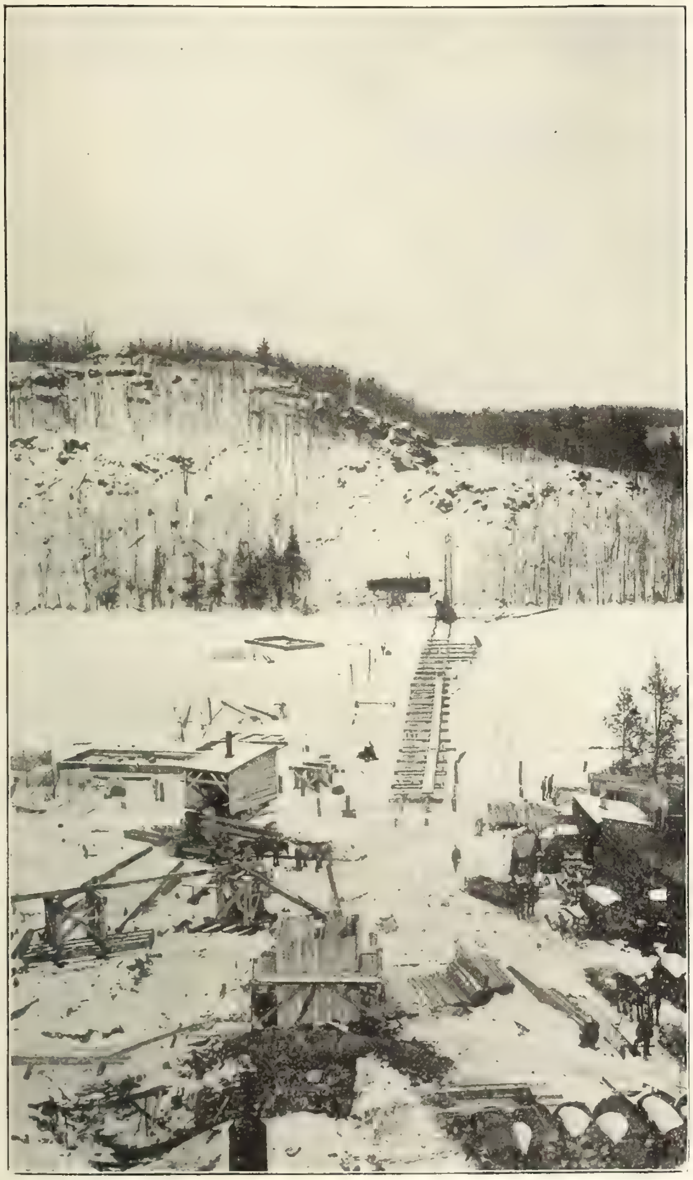

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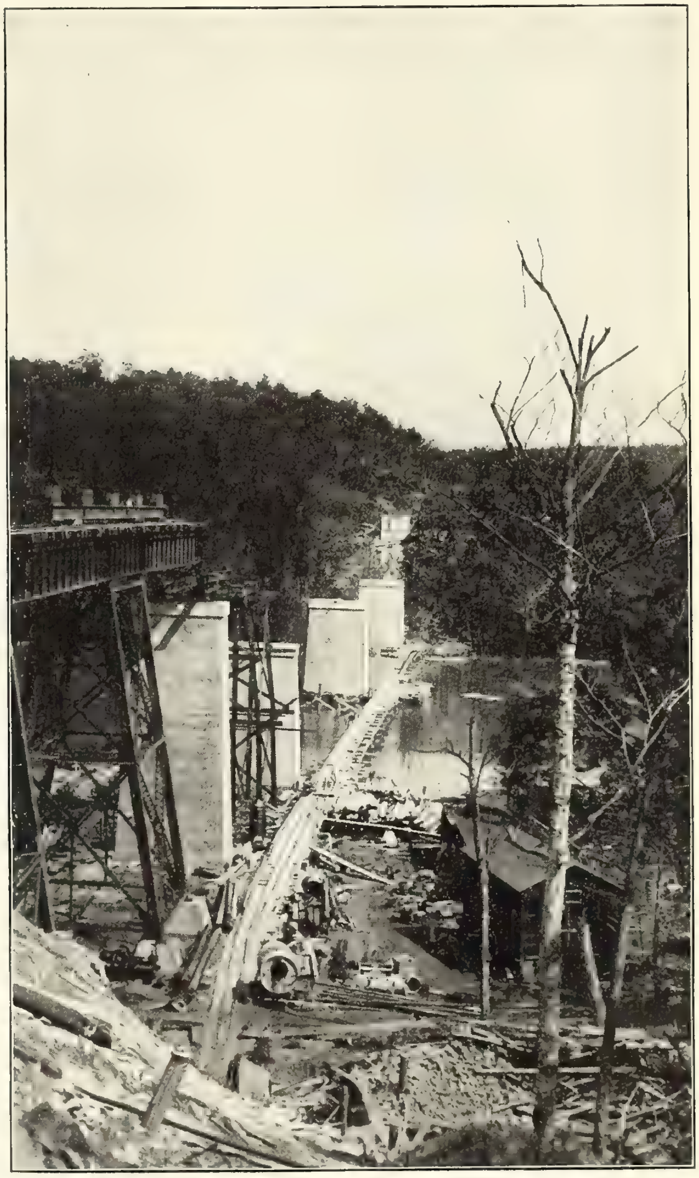

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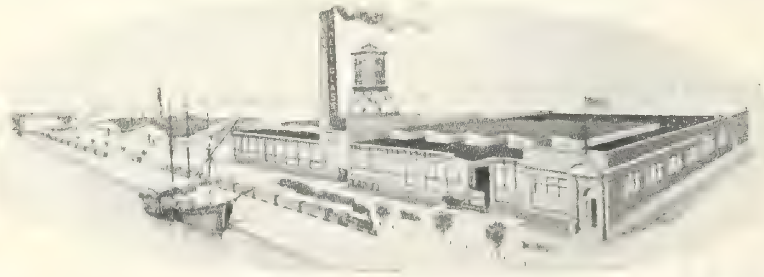

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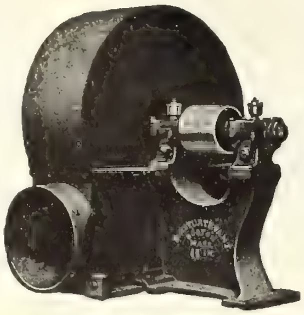

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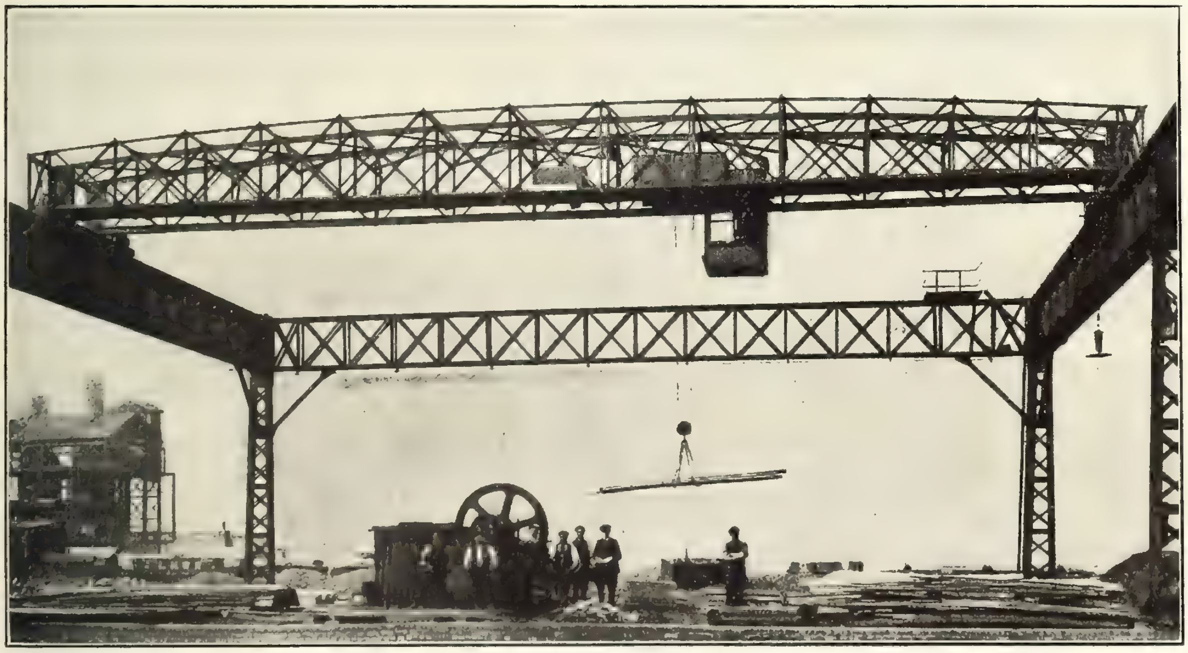

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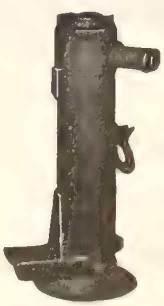

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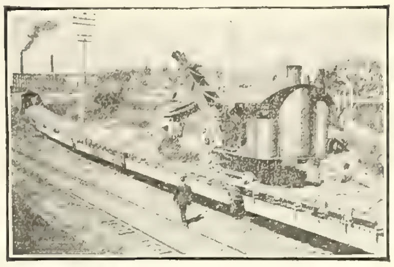

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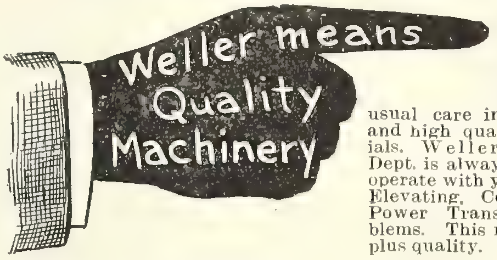

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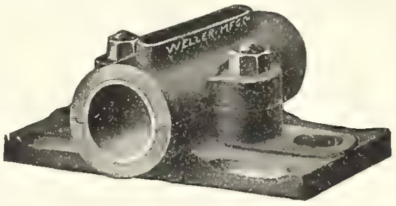

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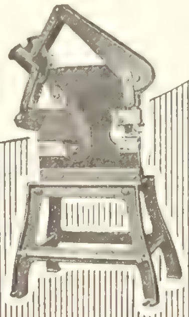
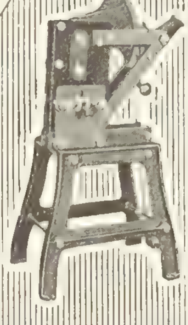
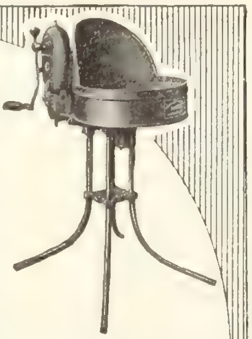




"Buffalo" Forges



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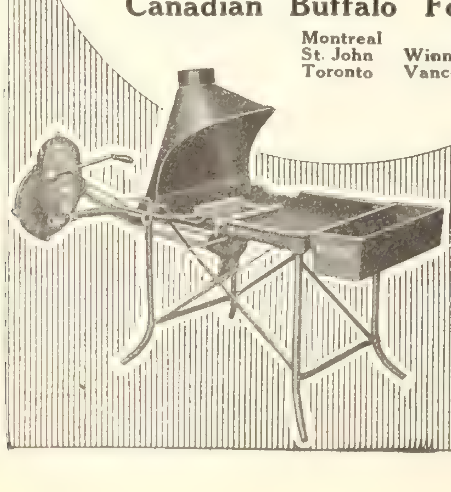

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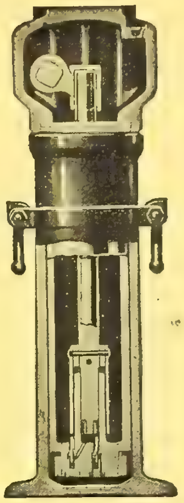

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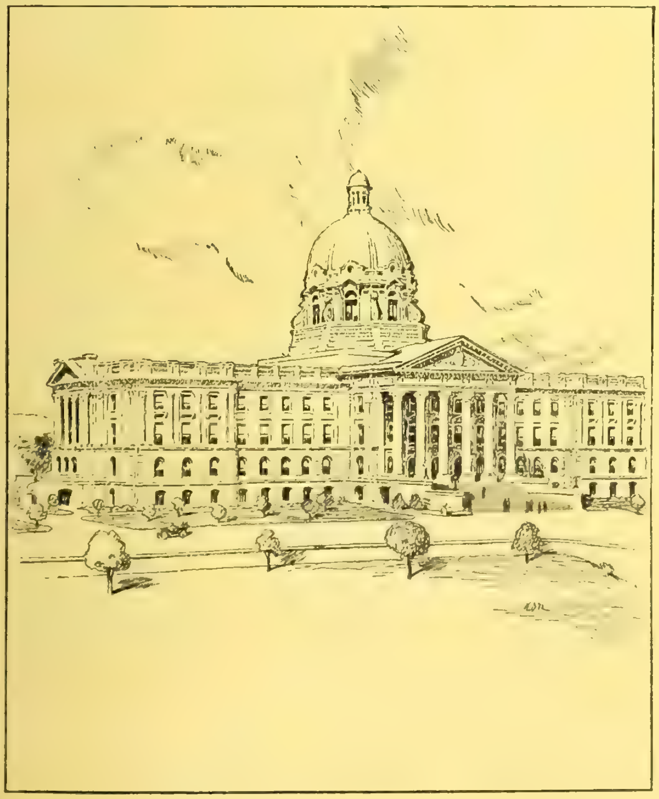

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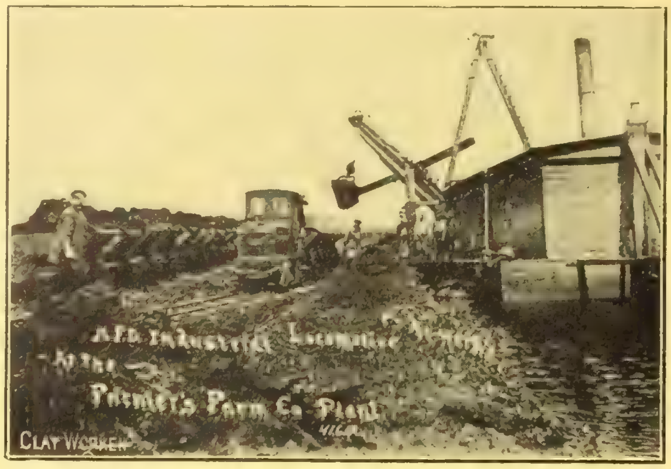

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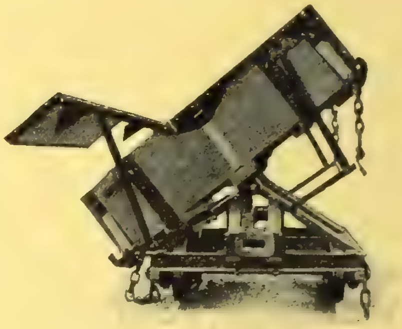

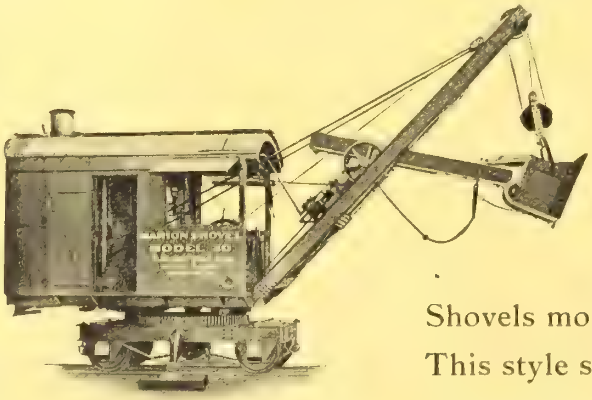

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Revolving Type

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Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines —Quarries, etc. Full details sent upon request.

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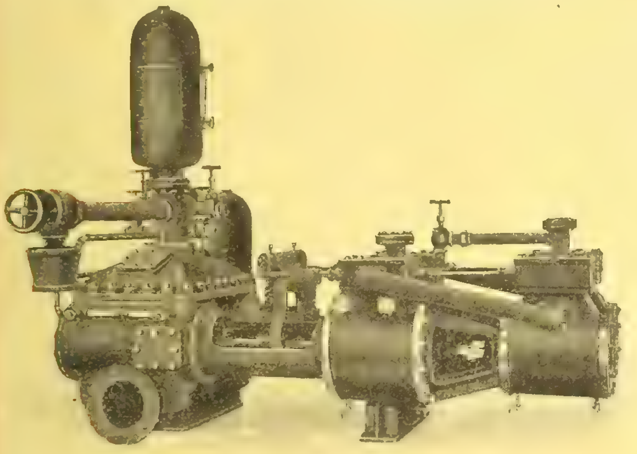

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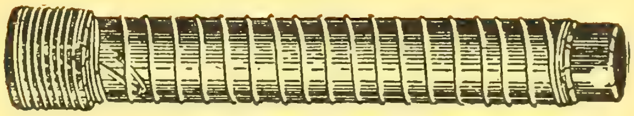
The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

Air Compressors
OF BELLISS MAKE
have gained their reputation for

- Simplicity of Design
- Noiseless Running
- Compact Design
- Low Oil Consumption
- Continuous Operation
- Overall Efficiency

Messrs. Belliss & Morcom, Ltd.
BIRMINGHAM, ENGLAND
Agents
Laurie & Lamb
Board of Trade Building, MONTREAL



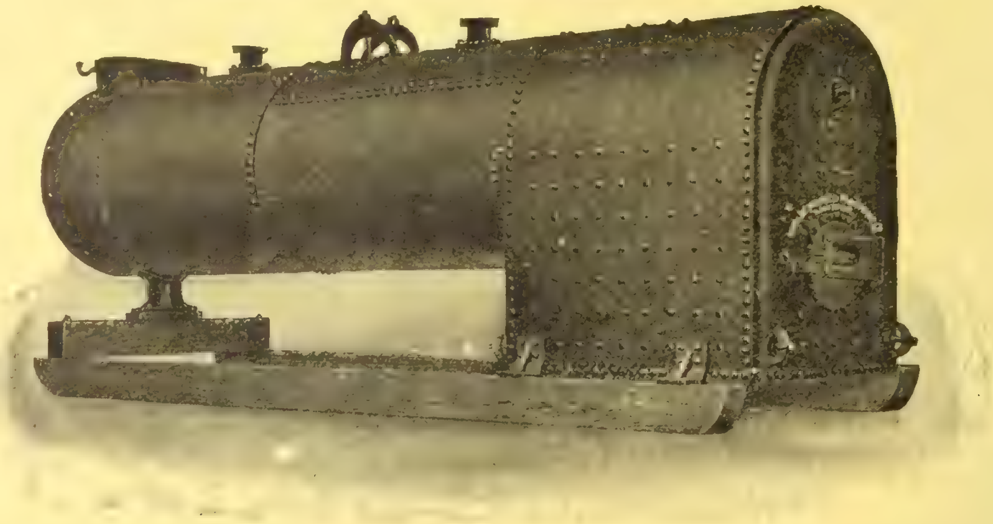
Continuous and Machine Banded Wood Stave
WATER PIPE
RESERVOIR TANKS
for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 16 Classified Directory to Advertisements, Page 6

BOILERS

Portable and Stationary Locomotive Boilers for every phase of contracting work.



THE JENCKES MACHINE COMPANY, LIMITED

Sherbrooke Montreal Toronto St. Catharines Cobalt South Porcupine Nelson Vancouver

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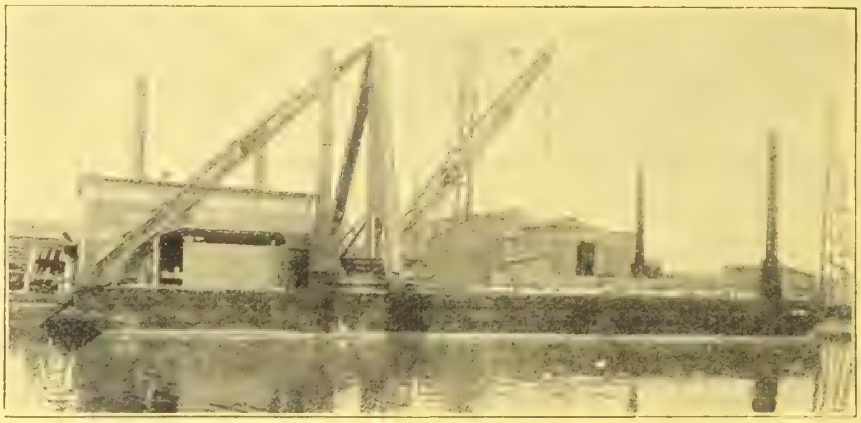


Here Is One of The Most Powerful Steel Barge Derricks Ever Built

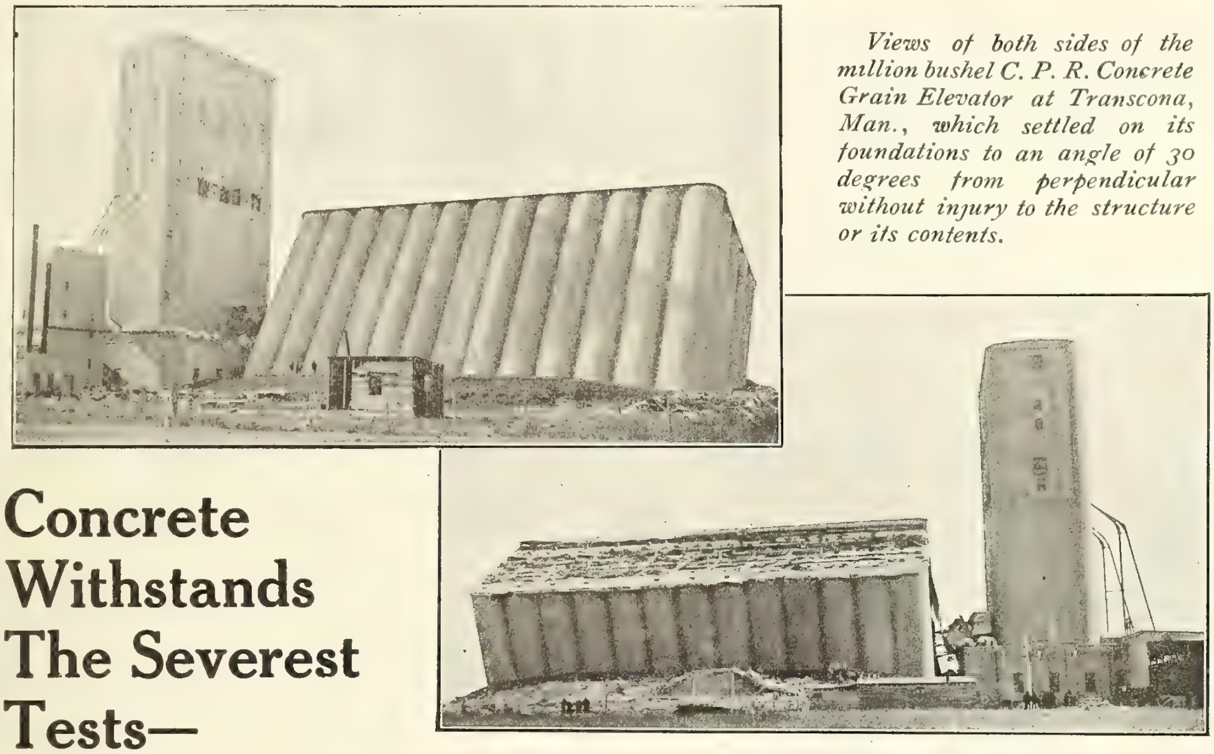
It's an "AMERICAN," of course.
50 tons is its nominal capacity.

This great barge derrick was built for the G. H. Starke Dredge and Dock Co., of Milwaukee, and is a convincing testimonial to the skill of our engineers and the efficiency of our shops.

AMERICAN HOIST & DERRICK COMPANY,
ST. PAUL, MINN., U.S.A.

General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Gorman Clancey & Grindley, Edmonton, Alta., and Nelson, B.C.

Stuart Machinery Co., Winnipeg, Man.
Vancouver Machinery Depot, Vancouver, B.C.



Views of both sides of the million bushel C. P. R. Concrete Grain Elevator at Transcona, Man., which settled on its foundations to an angle of 30 degrees from perpendicular without injury to the structure or its contents.

Concrete Withstands The Severest Tests—

In the San Francisco earthquake and the Ohio floods, concrete structures withstood the terrific tests of fire, water and vibration without damage.

Now, right in our very midst, comes a striking illustration of concrete's enormous power of resistance and durability.

This great concrete structure, built only to resist the pressure of grain from the inside, while filled almost to capacity with 55,000,000 pounds, or 27,500 tons of grain, settled to an angle of 30 degrees from its original perpendicular position.

In the settling, the walls were subjected not only to the terrific twisting strain of their own weight, but to the weight of thousands of tons of grain as well.

Contract for the restoration of this enormous structure has been awarded to Barnett & McQueen, and it is anticipated that it will be put back into its original position without the slightest injury.

No Loss of Contents

Think of the irreparable loss, had this elevator been built of some destructable material—a material that would have collapsed almost as soon as the settling commenced, and which would have entailed not only the loss of the building, but almost a total loss of its contents.

We have published a number of books which contain the most complete information and beautiful illustrations of almost every use of Concrete (Building, Roads and Pavements) for the architect, engineer, contractor, business-man, manufacturer and everyone interested in a material of such permanence and economy.

These books are free and you may have a copy for the asking—simply state what subject you are interested in, on a post card, and send to

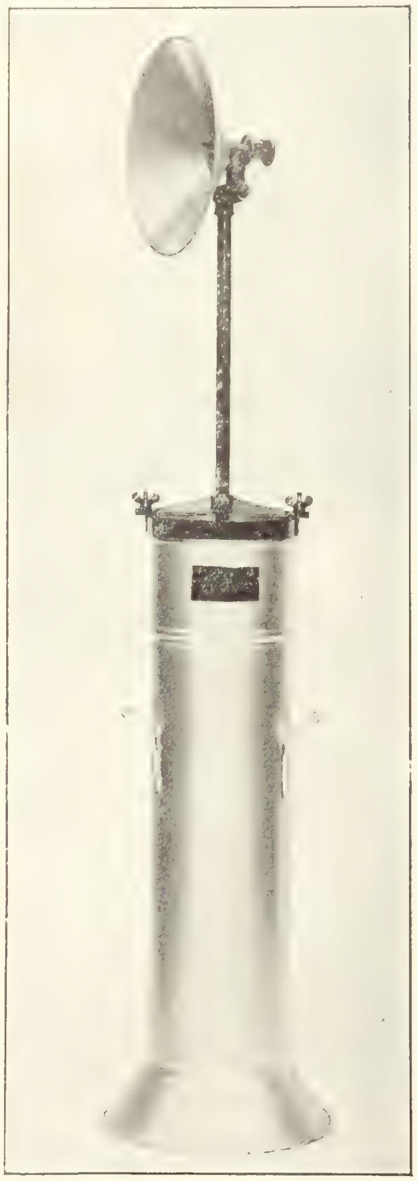
Information Department

Canada Cement Company

Limited
880 Herald Building
Montreal

Sales Offices at
MONTREAL
TORONTO
WINNIPEG
CALGARY

Light Efficiency



Are you obtaining
2000 c.p.
at the 5c. an hour rate?
If not — Buy the

Carbic Light

It gives a clear white light of 2000 c.p. at an approximate cost of 5c. per hour, without waste.

Is Absolutely Non-Explosive, Strong and Durable.

Turns your night into day.

Carried in Stock.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 318 Richards St.

QUEBEC, 31 St. Louis St.
ST. JOHN, N. B., 57 Smythe St.
HALIFAX, 78 Granville St.

NORTON JACKS

ARE GOOD JACKS

Nothing to freeze.

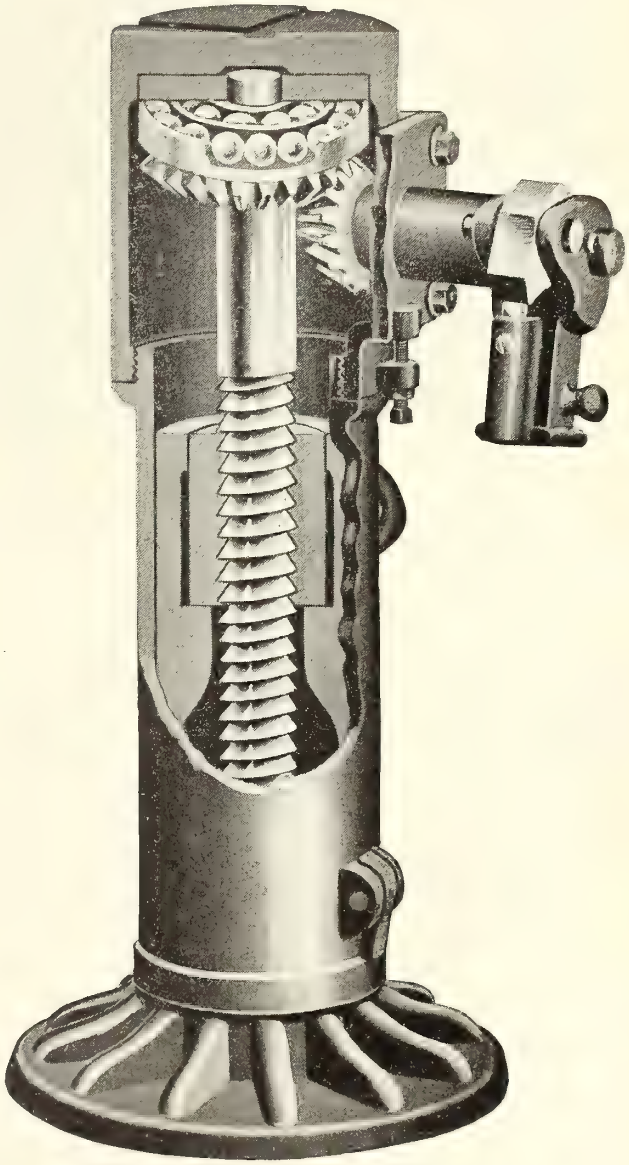
Hold the load positively.

Cannot slip or drop.

Wear the longest and are the most economical.

Norton High Speed Jacks will lift and lower their full rated capacity four times as fast as any other ball-bearing jack of equal capacity.

The Norton Jack is the kind that can be depended upon in an emergency.



Jacks for all purposes carried in stock
Capacities up to 100 tons

Mussens Limited

MONTREAL 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 318 Richards St.

QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

CLASSIFIED INDEX TO ADVERTISEMENTS

The following regulations apply to all advertisers:—Eighth page, two headings quarter page, four headings; half page, eight headings; full page, sixteen headings.

Air Compressors
- Canadian Allis-Chalmers, Limited
- Canadian Fairbanks-Morse Co.
- Can. Ingersoll-Rand Co., Ltd.

Architects
- Weeks, Arthur L.

Architects' Instruments
- Stanley Co., W. F.
- W. & L. E. Gurley.

Architectural Iron Work
- Canadian Allis-Chalmers, Limited
- Canada Wire & Iron Goods Co.
- Dennis Wire & Iron Works
- Eberhard & Wood
- McGregor & McIntyre
- Meadows Co., Geo. B.
- Steel & Radiation Ltd.

Architectural Metal Work
- Feather & Roadhouse
- Ormsby Co., Limited, A. B.
- Metallic Roofing Co.

Architectural Terra Cotta
- Black Building Supply Co., Ltd.
- Don Valley Brick Works
- Gibbs & Canning
- Northwestern Terra-Cotta Co.
- Toronto Plate Glass Imp't'g Co.

Asphalt
- Asphalt & Supply Co.
- Barber Asphalt Paving Co.

Belting
- Can. Consolidated Rubber Co.
- Federal Engineering Co., Ltd.
- Goodyear Tire & Rubber Co.
- Can. Fairbanks-Morse Co.
- Dominion Belting Co.

Blowers
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Can. Ingersoll-Rand Co., Ltd.
- Sheldons Limited
- Sturtevant Co. of Can., Ltd., B. F.

Boilers
- Berg Machinery Mfg. Co.
- Canadian Allis-Chalmers, Ltd.
- Boving Company of Canada
- Inglis Company, John
- Jenckes Machine Co.
- Leonard & Sons, E.
- Marsh & Henthorn
- McDougall Caledonian Iron Wks.
- Mussens Limited
- Waterous Engine Works Co.

Boxes—Junction
- Standard Underground Cable Co. of Canada Limited

Brewers' Machinery
- Linde British Refrigeration Co.

Brick
- American Enamelled Brick Co.
- Black Building Supply Co., Ltd.
- Bradford Pressed Brick Co.
- Don Valley Brick Works
- Hamilton Pressed Brick Works
- North-Western Terra Cotta Co.
- Nova Scotia Clay Works
- Sydney Pressed Brick Co.
- York Sandstone Brick Co.

Brick Machinery and Supplies
- Bechtels Limited
- Berg Machinery Mfg. Co.
- Sheldons Limited

Bridges (Steel)
- Canadian Allis-Chalmers, Ltd.
- Canadian Bridge Co.
- Chicago Bridge & Iron Works
- Des Moines Bridge & Iron Co.
- Dickson Bridge Works
- Dominion Bridge Co.
- Hamilton Bridge Works Co.
- Mackinnon-Holmes & Co.
- Manitoba Bridge & Iron Works
- Maritime Bridge Company
- National Bridge Co.
- Phoenix Bridge & Iron Works
- Sarnia Bridge Co.
- Scherzer Rolling Lift Bridge Co.
- Structural Steel Co.
- Standard Steel Construction Co.

Brick Dryers
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Bechtels Limited
- Berg Machinery Mfg. Co.

Buckets
- American Hoist & Derrick Co.
- Browning Engineering Co.
- Canadian Fairbanks-Morse Co.
- Lecky & Collis
- Thew Shovel Company
- Weller Mfg. Co.

Cable
- Canada Wire & Cable Co.
- Imperial Wire & Cable Co.
- Standard Underground Cable Co. of Canada, Limited

Cement
- Alsen Portland Cement Co.
- Britnell & Co.
- Bremner, Alex.
- Canada Cement Co.
- McNally & Co., W.
- Morrison & Co., T. A.
- Ontario Lime Co., Ltd.
- Rogers, Alfred, Limited
- Smyth & Ryan

Cement Tools
- Abram Cement Tool Co.
- Wettlaufer Bros.

Chain
- McKinnon Chain Co.

Coal Chutes
- Galt Stove & Furnace Co.

Coal Handling Apparatus
- American Hoist & Derrick Co.
- Browning Engineering Co.
- Brown Hoisting Machinery Co.
- Weller Mfg. Co.

Combination Woodworkers
- Hutchinson, M.

Concrete Mixers and Appliances
- Canadian Allis-Chalmers, Ltd.
- Canadian Concrete Appliance Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- London Concrete Machinery Co.
- Mussens Limited
- Wettlaufer Bros.
- Woodstock Wind-Motor Co.

Contractors' Barrows
- Erie Iron Works

Conduits
- Can. H. W. Johns-Manville Co.
- Conduits Co., Limited
- Orpen Conduit Mfg. Co. of Can.

Contractors
- Eastern Pipe Construction Co.
- Foundation Company, Limited
- Reggin & Spence
- Wells & Gray.

Contractors' Plant & Supplies
- American Hoist & Derrick Co.
- Barber Asphalt Paving Co.
- Bateman Wilkinson Co.
- Beatty & Sons, M.
- Browning Engineering Co.
- Canadian Allis-Chalmers, Ltd.
- Can. Billings & Spencer
- Canadian Fairbanks-Morse Co.
- Canadian Locomotive Company
- Canadian Brakeshoe Co. Limited
- Canadian Concrete Appliance Co.
- Dake Engine Co.
- Dore & Fils
- Dull Co., Raymond W.
- Erie Iron Works
- Hamilton Mfg. Co., Wm.
- Hepburn & Co., J. T.
- Hopkins & Co., F. H.
- International Marine Signal Co.
- Lecky & Collis
- Marsh & Henthorn
- McKinnon Chain Co.
- Montreal Locomotive Works
- Mussens Limited
- Royce Limited
- Schell Foundry & Machine Co.
- Stinson-Reeb Builders' Supply Co.
- Woodstock Wind-Motor Co.
- Wettlaufer Bros.

Conveying Machinery
- Dull Co., Raymond W.
- Weller Mfg. Company

Core Drills
- Can. Ingersoll-Rand Co., Ltd.

Cork Installation Machinery
- Linde British Refrigeration Co.

Corrugated Iron
- Can. H. W. Johns-Manville Co.
- Metallic Roofing Co.
- Ormsby, A. B., Limited

Cranes, Travelling and Locomotive
- American Hoist & Derrick Co.
- W. D. Beath & Son
- Browning Engineering Co.
- Brown Hoisting Machinery Co.
- International Marine Signal Co.
- Royce Limited

Creosote Stains
- Cabot, Inc., Samuel

Crushed Stone and Granite
- Hagersville Contracting Co.
- Ontario Lime Co., Ltd.
- Rogers Supply Company
- Sand and Supplies Limited
- Smyth & Ryan

Crushers (Stone and Rock)
- Canadian Allis-Chalmers, Ltd.
- Hamilton Mfg. Co., Wm.
- Hopkins & Co., F. H.
- Jenckes Machine Co.
- Lecky & Collis
- London Concrete Machinery Co.
- Mussens Limited
- Wettlaufer Bros.

Derricks and Derrick Fittings.
- American Hoist & Derrick Co.
- W. D. Beath & Son
- Hepburn, John T.

Dredges
- Beatty & Sons, M.
- Browning Engineering Co.

Drills
- Beatty & Sons, M.
- Canadian Allis-Chalmers, Ltd.
- Canadian Buffalo Forge Co.
- Canadian Ingersoll-Rand Co.
- Lecky & Collis
- Star Expansion Bolt Co.

Drill Steel Sharpeners
- Canadian Ingersoll-Rand Co.

Drop Forgings
- Canadian Billings & Spencer, Ltd.

Dump Cars, Wheels, etc.
- Bechtels Limited
- Schell Foundry & Machine Co.
- Western Wheeled Scraper Co.
- Weller Mfg. Co.

Dump Carts and Wagons
- Troy Wagon Works

Electric Air Rock Drills
- Canadian Ingersoll-Rand Co.

Electrical Machinery and Supplies
- Ferranti Electrical Co.

Enamelled Brick
- American Enamelled Brick & Tile Company

Engines
- Boving Company of Canada
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Inglis Co., John
- Jenckes Machine Co.
- Laurie & Lamb
- Leonard & Sons, E.
- McDougall Caledonian Iron Wks.
- Mussens Limited
- Sturtevant Co. of Can Ltd., B. F.
- Waterous Engine Works Co.
- Wettlaufer Bros.

Engineers (Civil and Mechanical)
- Bowman & Connor
- Campbell, R.
- Chipman & Power
- Dominion Engineering & Inspection Company.
- Farmer, John T.
- Galt Engineering Co., John
- Lea & Ferguson
- Mitchell, C. H.
- Thorold Co., F. W.

Expansion Bolts
- Star Expansion Bolt Co.

Expanded Metal
- Mannesmann Tube Co.

Exhaust Heads
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.

Fans
- Canadian Sirocco Co.

Field Instruments
- Gurley, W. & L. E.

Filters
- American Water Softener Co.

Fire Brick
- Improved Equipment Co.
- Ontario Lime Co., Ltd.
- Smyth & Ryan

Fire Escapes
- McGregor & McIntyre

Fireproof Doors and Windows
- Feather & Roadhouse
- Metal Shingle & Siding Co.
- Mussens Limited
- Ormsby Co., Limited, A. B.
- Steel & Radiation Limited

Fuse (Safety Blasting)
- Lecky & Collis

Fixtures (Gas)
- Consumers Gas Co.

Forges
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Canadian Sirocco Co.

Forgings
- Canadian Billings & Spencer, Ltd.

Furnaces (Special)
- Improved Equipment Co.

Gasoline Engines
- Wettlaufer Bros.

Gas Plants Complete
- Improved Equipment Co.

Gas Producers for Heating
- Improved Equipment Co.

Gas Machinery
- Improved Equipment Co.

Glass
- Consolidated Glass Co.
- Hobbs Mfg. Co.
- Luxfer Prism Co.
- Toronto Plate Glass Imp't'g Co.

Gravel Washing Plants
- Dull Co., Raymond W.

Hammer Drills
- Canadian Ingersoll-Rand Co.

Heating Apparatus
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Sheldons Limited

High Pressure Pipe Lines
- Boving Company of Canada
- Escher Wyss & Co.
- Mannesmann Tube Company.
- Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Engineering Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
- Mussens Limited
- Royce Limited
- Sturtevant Co. of Can. Ltd., B. F.

Hoisting Engines
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Wettlaufer Bros.

Hydrants
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

(Continued on page 12)

Residence of W. W. Butler, Cote St. Antoine Road, Montreal.
Robt. Findlay, 10 Phillips Place, Architect.

Don Valley Brick

FOR the largest buildings, the finest residences and brick work in general Don Valley Brick stands pre-eminent.

The illustration shows a handsome Montreal residence in which Don Valley Bricks were used. The resultant rich effect of the brick work thoroughly justified the architect in specifying "Don Valley Bricks."

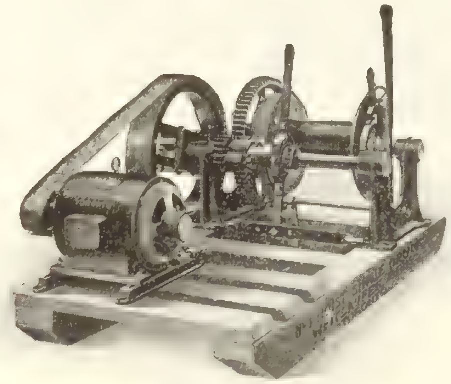
Don Valley Porous Terra Cotta Fireproofing is used for fireproofing most large buildings.

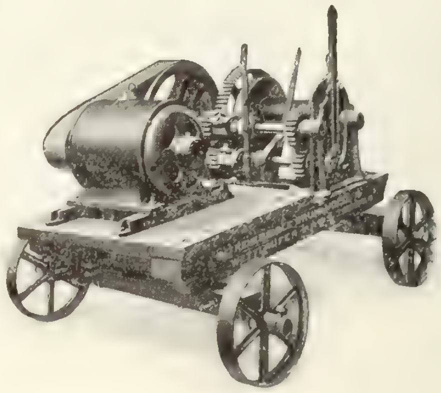
Don Valley Brick Works

Toronto, Ontario

Wettlaufer

Handy Hoists





The hoist illustrated is the Wettlaufer handy electric hoist, mounted on wheels or skid.

This is a particularly convenient hoist for contractors' use on light work.

Wettlaufer hoists are made in fourteen different types and sizes to suit every class of work ; power is supplied by electricity, steam or gasoline.

The Wettlaufer line also includes the famous heart shape drum mixer, made in many sizes and styles. Daily demonstrations are held at all our branches. If you are interested in the purchase of new equipment call at any branch and we will demonstrate our claim.

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

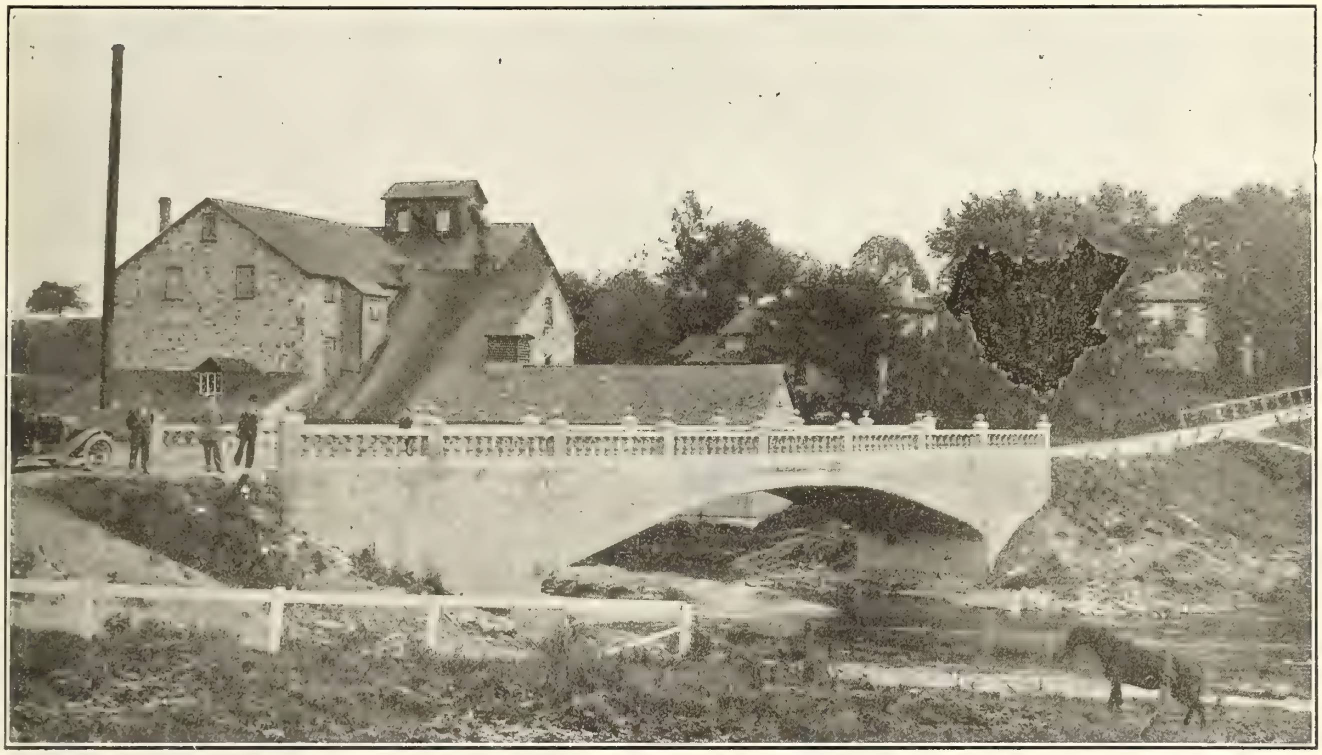
Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask. ; Maysmith & Lowe, 1057 Mears St., Victoria, B C. ; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B. ; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C. ; J. L Lachance, Ltd., 363 St. Paul St., Quebec ; Wettlaufer Bros., 316 Lagauchetiere St. W., Montreal.

Rogers' Portland Cement

AND CRUSHED STONE



Concrete Arch Bridge of Embro, Ont., built with Rogers' Cement

C. E. URE, Woodstock, ENGINEER **BAIN & ROSS, Embro, CONTRACTORS**

Cost price $4,200. Length of span 75 ft. Total length of bridge, including wings, 120 ft. Ten tons twisted bars used in reinforcment.

Rogers' cement is the most dependable for all types of construction and engineering-contracting work—especially where the finished structure must bear water pressure without leaking—such as tanks, reservoirs, etc.

Our mills produce no "second quality" cement. They are standardized to the "Rogers'" grade, which means more than standard. We have never been content merely to "come up to specification." Rogers' Cement is ground and screened carefully to give large covering power, speed of set and maximum strength. It can take up a large proportion of aggregates. Rigid care is given to the proportioning of materials for each batch. Rogers' service combines large reserve stocks with facilities for prompt deliveries.

CRUSHED STONE

Our crushed stone is free from dust, dirt and mold—it is really clean stone —properly sized. Large stock always available of all sizes. Speediest delivery. Telegraph or telephone your order at our expense.

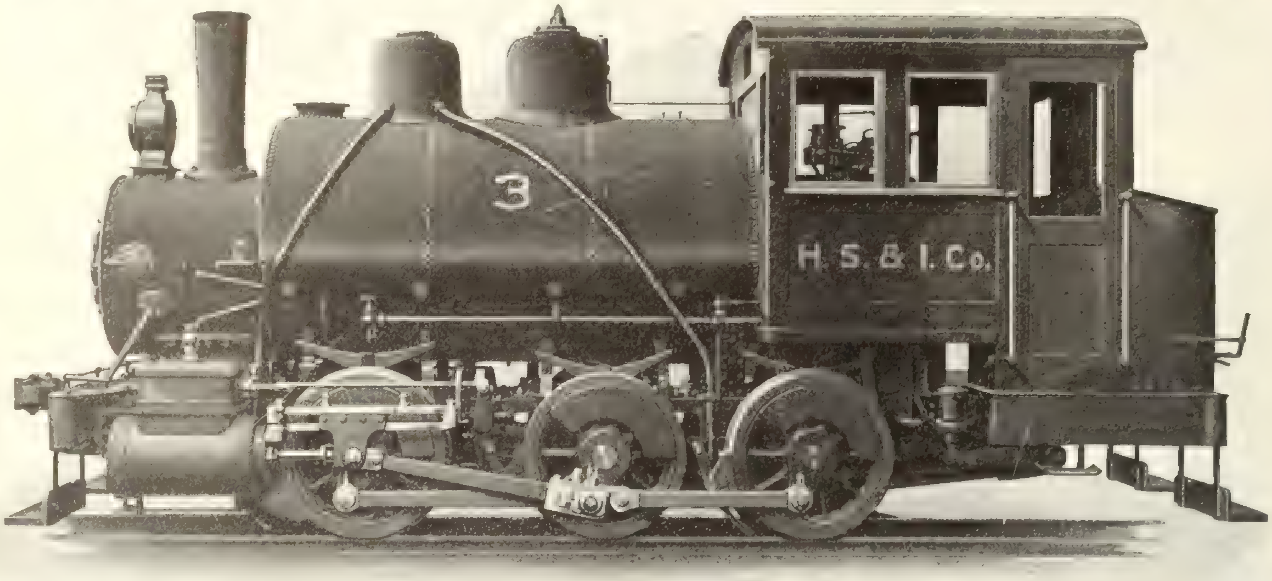
Quarries at Dundas and Vinemount

Write or wire for quotations

ALFRED ROGERS, LIMITED

28 King Street West, Toronto

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

Astrakhan Brick
Bokhara "
Kushequa "
Moquette "
Shawnee "
Turkestan "

Rough and Smooth Surfaces

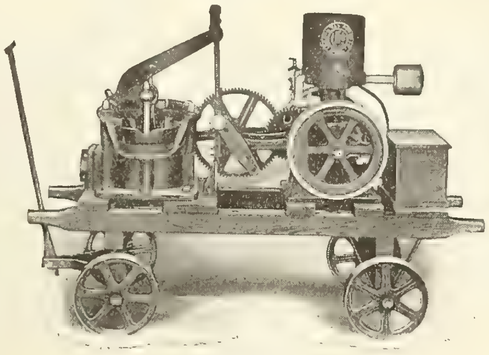
Salt Glazed, Enamel and Paving Bricks

Selected Fireplace Brick Carried in Stock

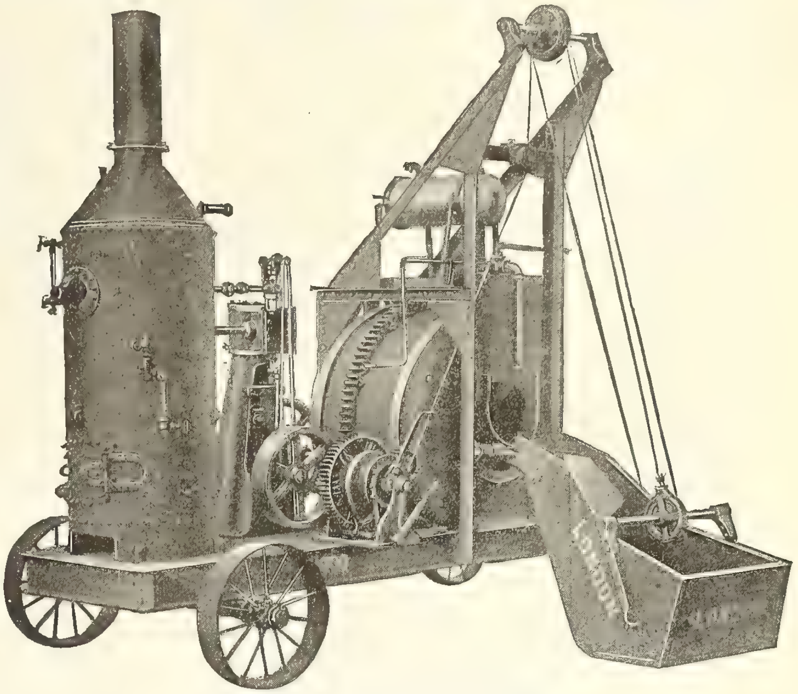
BLACK BUILDING SUPPLY CO., LTD. - TORONTO

Before You Buy Concrete Machinery

or Equipment of any kind, write us for our 180 page catalogue.



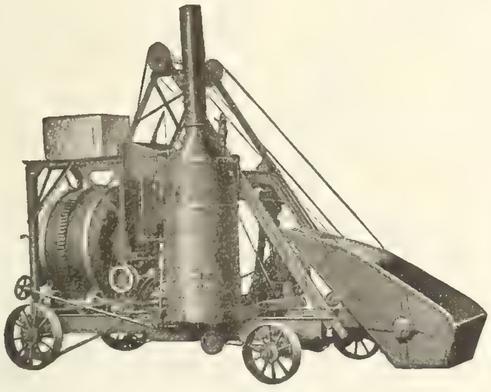
Power Diaphram Pump



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

We are the largest manufacturers of Concrete Machinery in Canada.



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

We do not build machinery down to a price but up to a standard.

London Sill Step and Window Cap Mould

A few lines we manufacture—

Concrete Mixers, Mortar Mixers, Tile Moulds, Drain Tile Machines, Side Walk Tile Machines, Cement Block Machines, Cement Brick Machines, Sill Step and Window Cap Moulds, Gasoline Engines, Screens and Elevators, Fence Post Moulds, Hoisting Engines, Material Elevators, Concrete Carts, Wheelbarrows, Scrapers, Sidewalk Forms, Pumping Outfits

A complete line of Contractors' Tools.

London Concrete Machinery Co., Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:
WINNIPEG (445 Main St.) W. H. Rosevear, Mgr. CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (36 Alhambra Ave.) F. D. Emsley, Mgr.

AGENCIES:
VANCOUVER, B. C. Equipment Co. MOOSE JAW, Sask. Bridge & Iron Co., Ltd. REGINA, H. A. Knight
FORT WILLIAM, Northern Eng. & Supply Co. MONTREAL, Foss & Hill Mach. Co. QUEBEC, A D. Masson

We are the Largest Manufacturers of Concrete Machinery in Canada.

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Ice-making Machinery
- Linde British Refrigeration Co.

Insulating Compounds
- Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
- Batts Limited
- Canada Office & School Fur. Co.
- Rhodes Curry & Co.

Kilns
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.
- Canadian Sirocco Co.
- Berg Machinery Mfg. Co.

Lighting and Pumping Installations
- Lister & Co., Ltd., R. A.

Lime
- Jamieson Lime Co.
- Ontario Lime Co., Ltd.

Lime Kilns
- Improved Equipment Co.

Locomotives
- Buffalo Pitts Co.
- Boving Company of Canada
- Canadian Allis-Chalmers, Ltd.
- Canadian Locomotive Company
- Montreal Locomotive Works
- F. H. Hopkins Co.
- Mussens Limited

Marble
- Mississquoi-Lautz Corporation

Metal Lath
- Greening Wire Co., B.
- Metallic Roofing Co.
- Noble, C. W.
- Steel & Radiation Ltd.

Meters, Electrical
- Ferranti Electrical Mfg. Co.
- Canadian Allis-Chalmers, Ltd.

Metal Forms
- Hotchkiss Lock Metal Form Co.

Meters, Water
- Hopkins & Co., F. H.
- McDougall Caledonian Iron Wks.
- Neptune Meter Co.

Paints (Bridge and Structural Iron and Pipe Coating)
- Dominion Paint Works
- Goheen Mfg. Co.
- Ottawa Paint Co.

Paints and Varnishes
- Dominion Paint Works
- Goheen Mfg. Co.

Paving and Paving Materials
- Asphalt & Supply Co.
- Barber Asphalt Paving Co.
- Dominion Creosoting Company
- Ontario Asphalt Block Co.
- Paterson Mfg. Co., B.

Perforated Metals
- Canada Wire & Iron Goods Co.
- Greening Wire Co., B.

Pipe (Concrete, Iron and Wood)
- American Spiral Pipe Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Pipe Co.
- Dominion Concrete Co.
- Dominion Wood Pipe Co.
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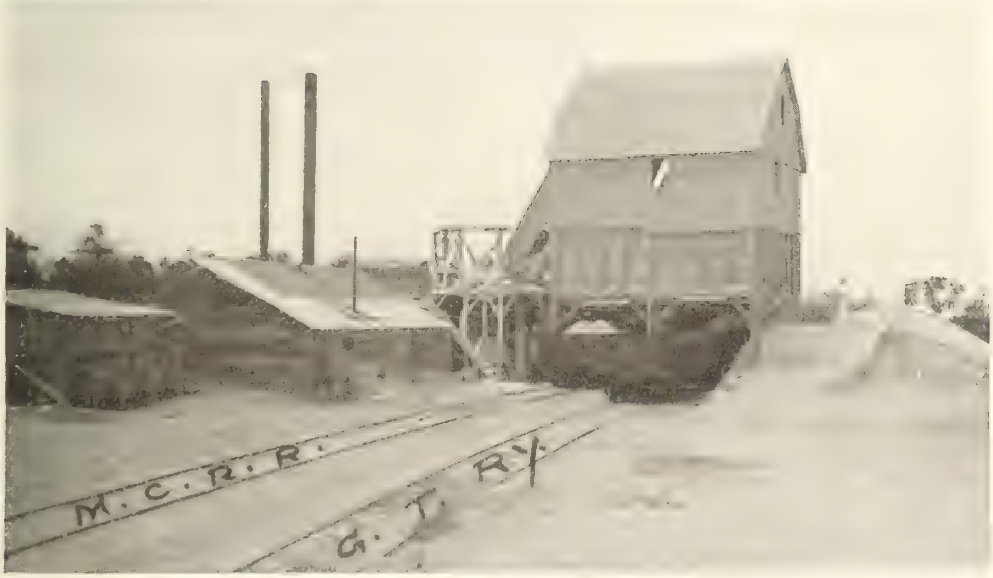

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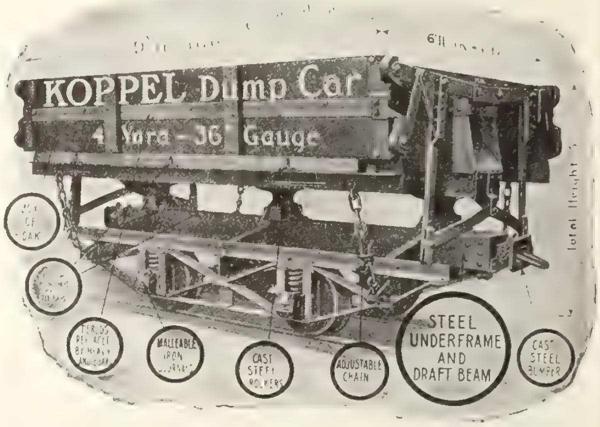

Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein - Arthur Koppel Co.

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Barrett Specification Roofs are roofs of coal tar pitch and tarred felt, with a top surface of slag, gravel or tile, ***laid according to the Barrett Specification.***

This specification is simply the standard formula for building a first-class roof of this character.

It is possible, of course, to make an inferior roof of these materials either by poor workmanship or by using insufficient and poor goods. But if the Barrett Specification *is followed absolutely and the materials called for are used,* you are certain of getting the best value in roof coverings.

Such roofs usually last twenty years and over without leaks or repairs.

Barrett Specification Roofs are almost universally used on factories and buildings of large roof areas and where costs are carefully figured. They are equally good for city dwellings, warehouses, railroad buildings, etc.

Copy of the Barrett Specification with diagrams, mailed free on request to nearest office.

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General Contractor: C.E. Deakin
Roofers: Campbell & Gilday

Special Note We advise incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested. ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

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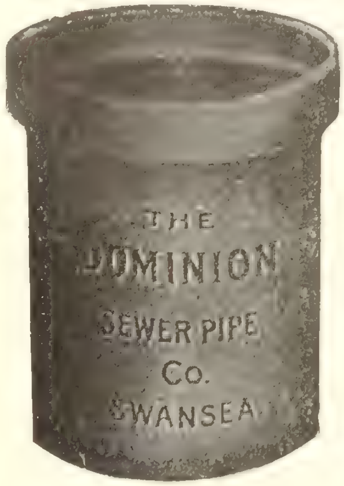

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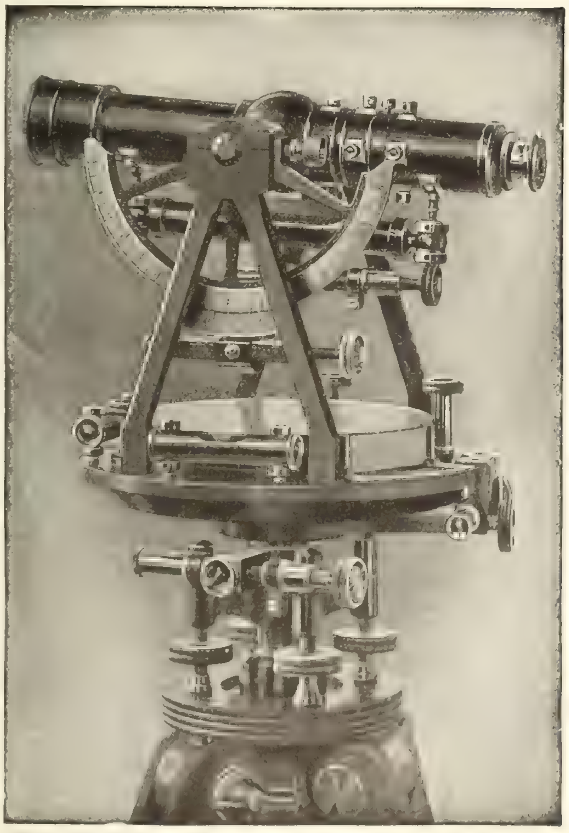

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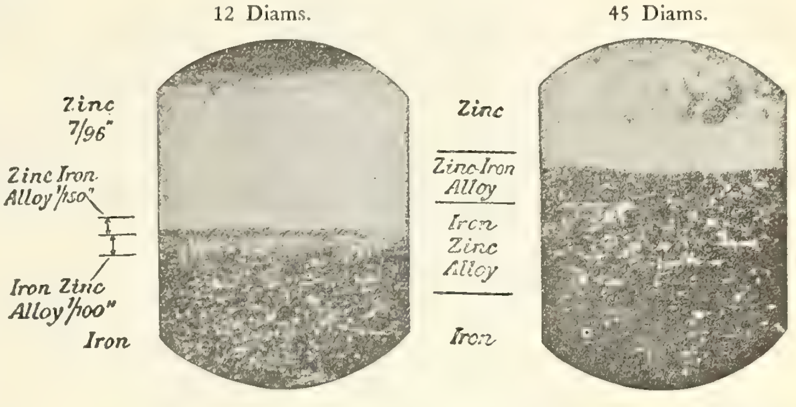

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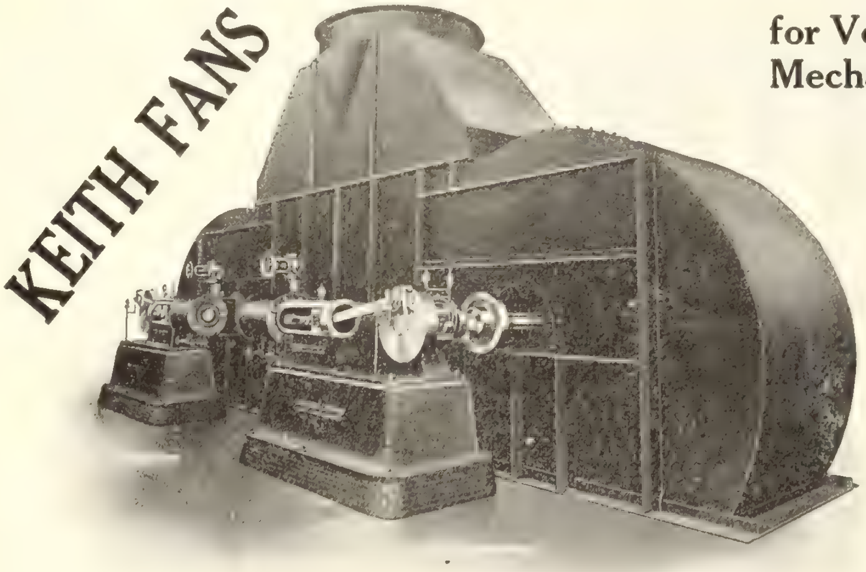

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"Keith" Fans now take the lead in the world's Fan Trade. All the leading Steamship Company's are now using these Fans for Forced Draft Engine Room, Stoke Hold and Cabin Ventilation.

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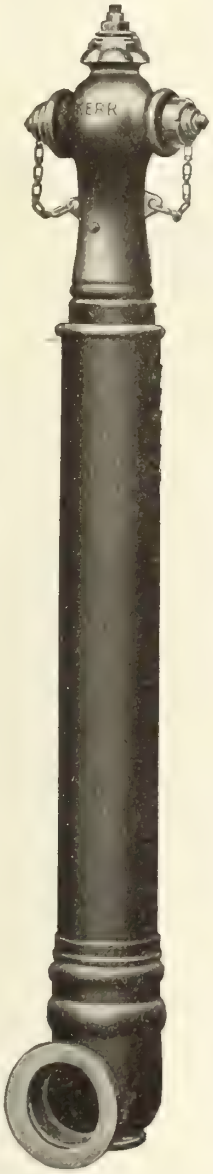

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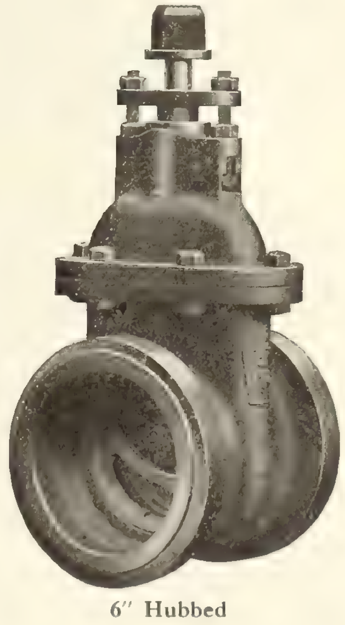

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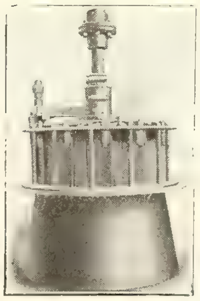

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The Samson wheel in official independent tests has shown very high efficiencies—reaching practically 90% (89.99). This is a guarantee that under your conditions our wheel will develop all the power possible, and give you results that cannot be surpassed by any wheel.

It is easy to install and to control when in operation and the workmanship, materials and performance are fully guaranteed.

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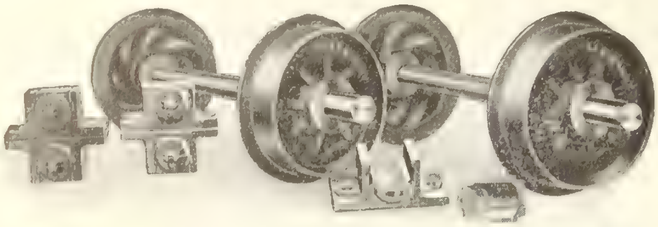

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The general use of the Thew Shovel in road building and street grading is conclusive proof that it is adapted to the conditions, economical for the purpose and efficient in operation. The following list of some of the contractors, in the State of New York alone, who have used and are using The Thew No. O Full Circle Swing Shovel in this class of excavation will indicate the popularity of the machine and its undisputed merit on such work:

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There is no other shovel of equal weight and dipper capacity that can handle as difficult material, nor under equal conditions, as large an output as the No. O Thew.

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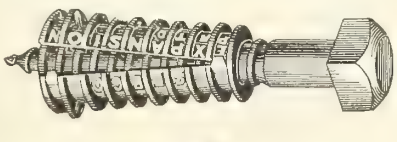

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are non-rusting. They are used for fastening small fixtures of all kinds to marble, tile, etc.

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Hoping that our wishes for a prosperous and happy New Year will be as welcome as our products, we are

Very truly yours,

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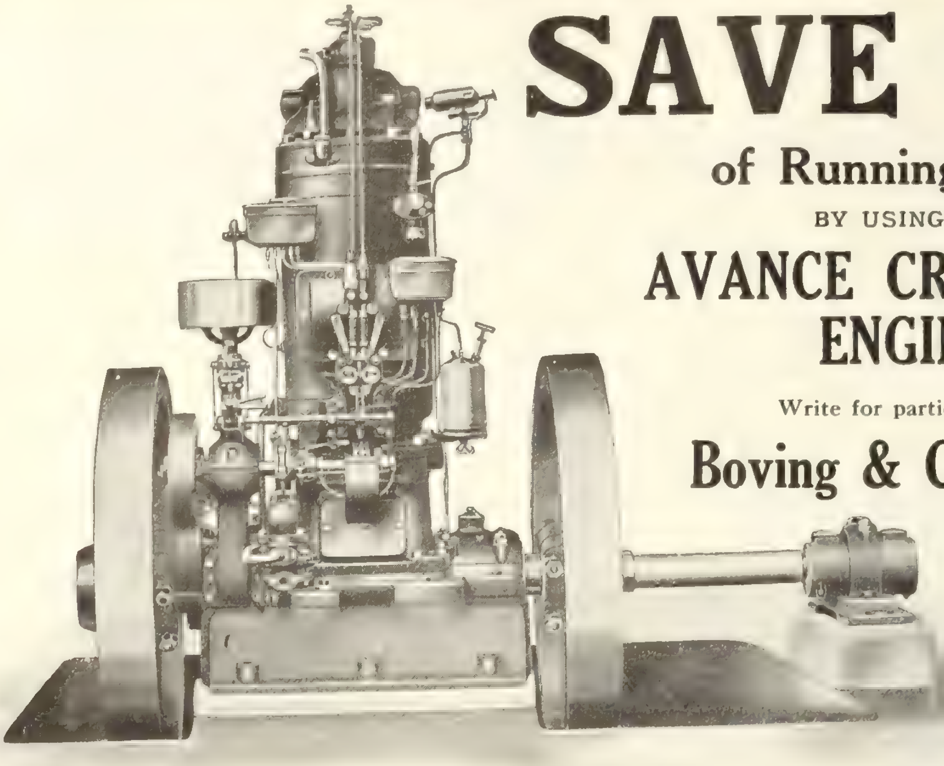

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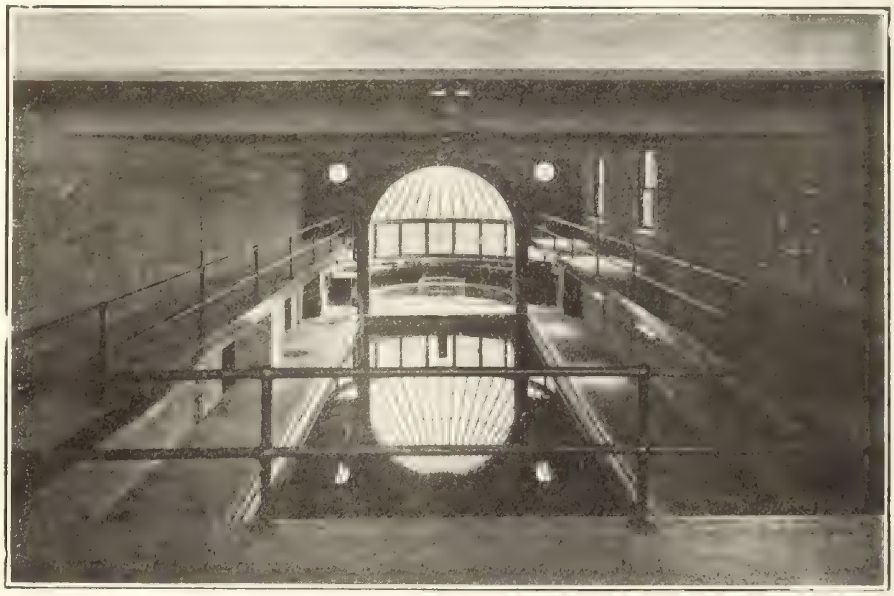

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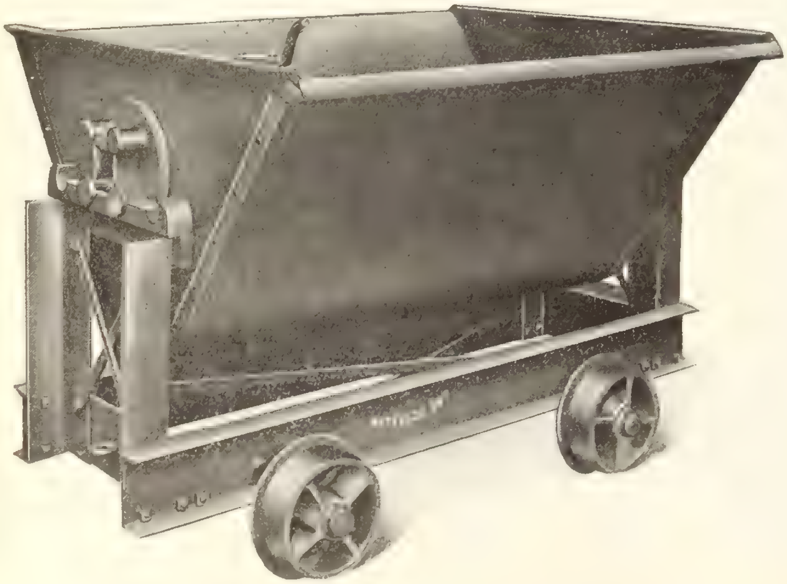

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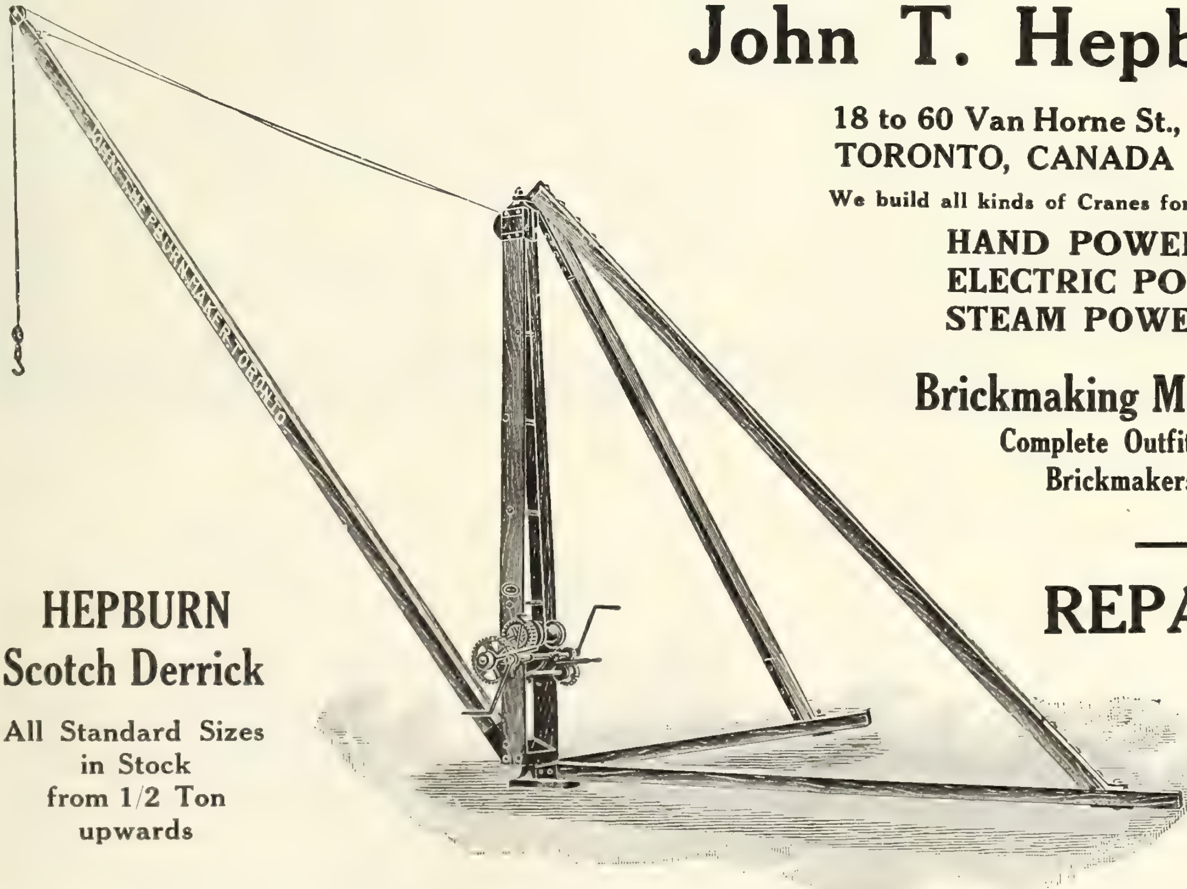
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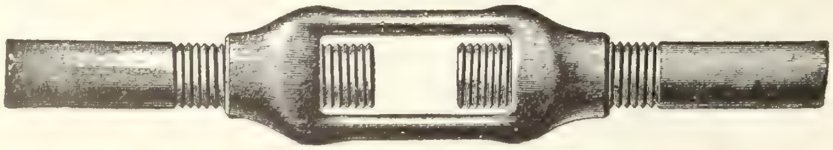

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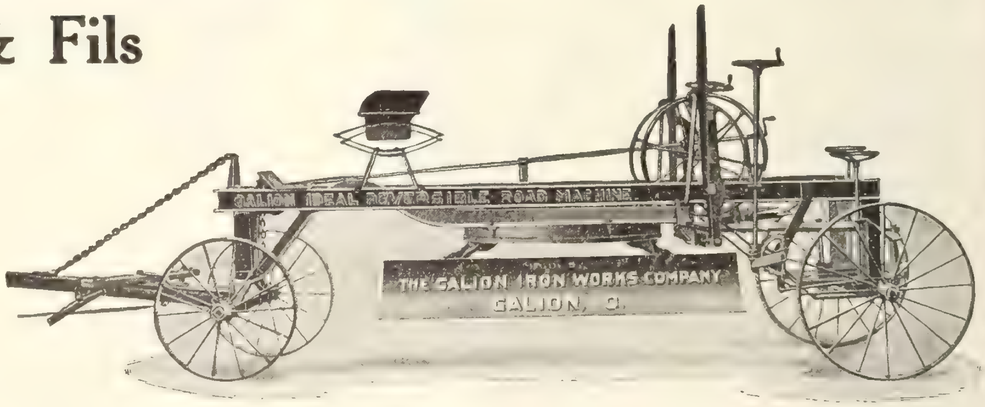
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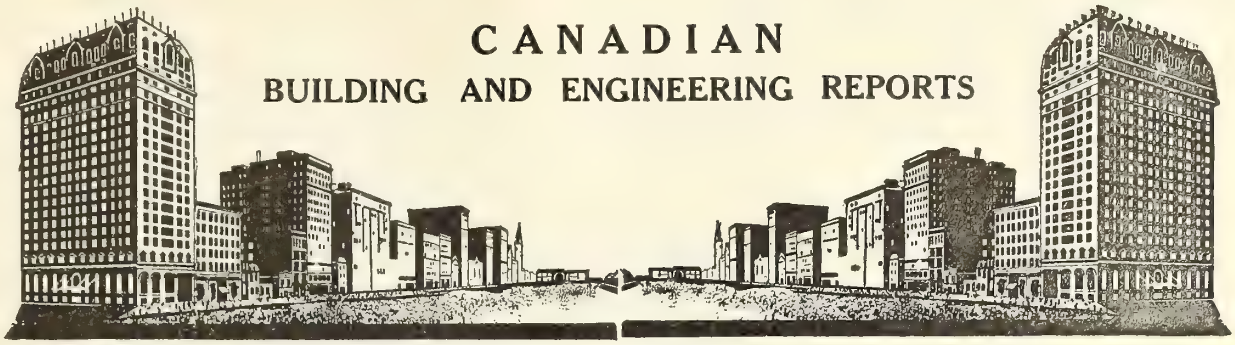

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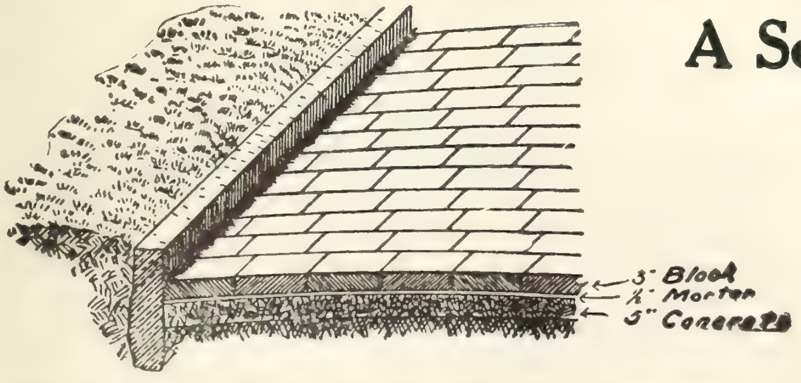

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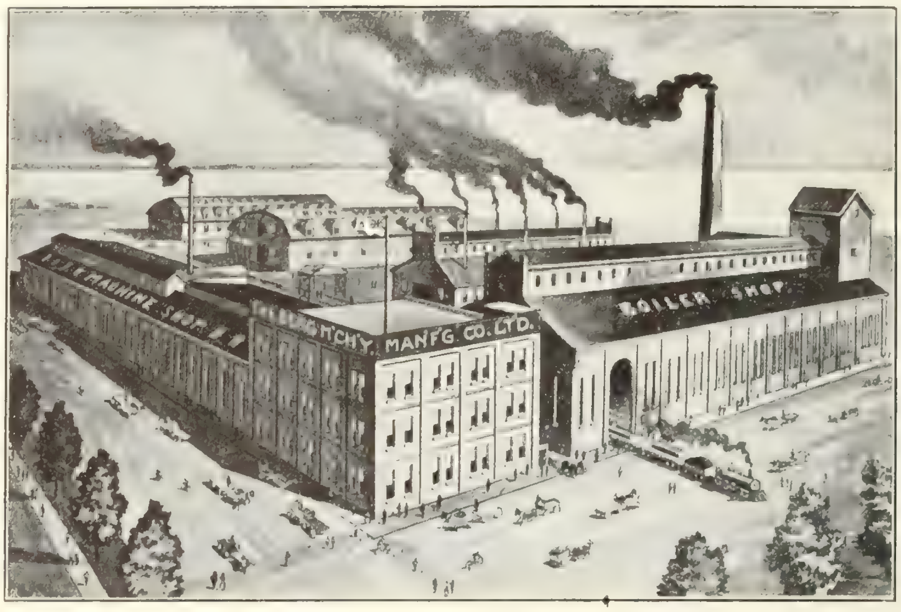

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FOR high speed a High Speed Belt should be used. Great strength is demanded. A belt that is to grip a small pulley and transmit high power must be specially built for the purpose. It must resist the strong tendency to slip on the small, rapidly-revolving pulleys.

This Goodyear High-Speed Belt is made with a friction surface that grips the face of the pulley—conveying **all** the power.

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Elevator Belts are a Goodyear Specialty. The essential requirement in these belts is strength—and Goodyear Elevator Belts have it. That is why they are in constantly increasing demand. The buckets do not pull out. Long wear in the belt is assured because the plies of fabric do not separate in service. Goodyear Rubber Belts are used in hundreds of elevators throughout Canada.

A seven hundred and fifty feet Goodyear Conveyor Belt in actual service at Rainy River, Vancouver.

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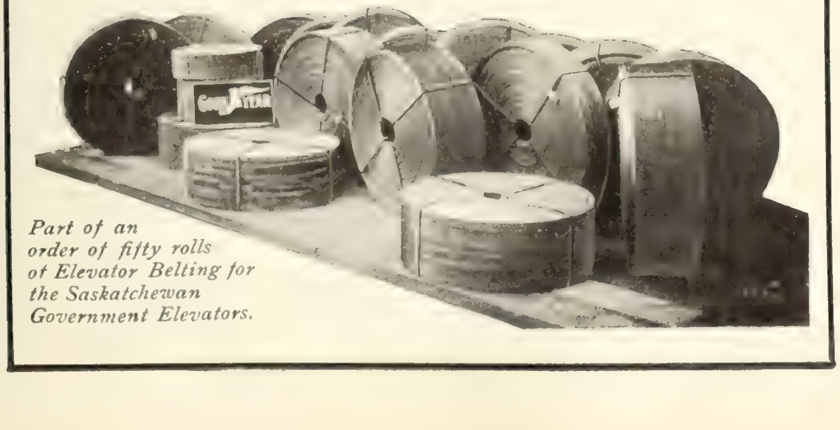
We make Endless Belts to order in any width, length and thickness—and for any purpose.



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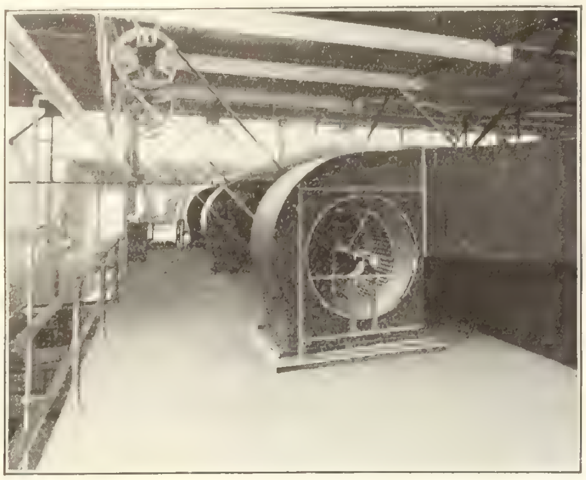

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8 of 29

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It isn't necessary for a plant to be large or new, to get the benefits of a "Sirocco" System. Any plant that has outgrown the capacity of its old system, or those who never had a system, appreciate **even more,** the great benefits derived from a "Sirocco" System of Heating and Ventilating.

We design the entire system to meet your requirements.

We give service with the sale of our product---Real-Expensive-Hard-to-Get Service.

Let us tender on your needs—and get advice from "Men who know." Catalogue No. 101 will be mailed at your request.

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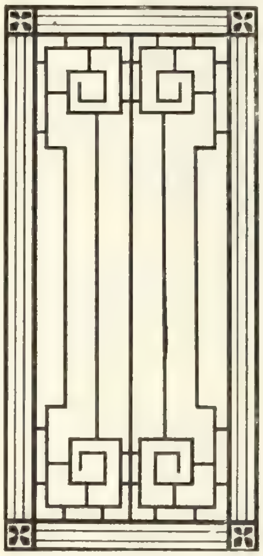

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Unharmed By Temperature Extremes

The extremes of temperature in most Canadian cities make asphalt more of a "problem" for Canadian engineers than it is for engineers in any other part of the Continent. Other asphalts that are entirely successful in South America, Mexico, Europe or in central or southern parts of the United States, might fail in Canada because of the extremes in temperature here.

For Canada asphalt must not only be pure (nearly 100 per cent. bitumen) but the bitumen must retain its tenacity at all temperatures. In this regard Aztec excels. It is impervious to water, stays malleable even when buried under snow or ice for long periods, does not soften noticeably in Summer and has great coherence, resisting wave tendencies.

Canadian municipal and highway engineers and road contractors should buy Aztec Asphalt on account of the qualities possessed by its bitumen. It is not—like other asphalts—merely "over 99 per cent. bitumen." Aztec is over 99 per cent. bitumen of special qualities that make it particularly suitable for Canadian requirements.

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Aztec is supplied with the consistency best suited to the special purposes for which it is required. Prompt deliveries on asphalt for

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Our Record with Some of the Largest Concerns in Canada

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In 1910 we built a three story reinforced concrete factory building for these people at Walkerville, Ont. Since that time our men have never been off the job. We have built two large extensions to main factory building, a large fireproof office building, an engine house, gas producer building, heat treatment building with two large extensions, amounting in all to $450,000.00.

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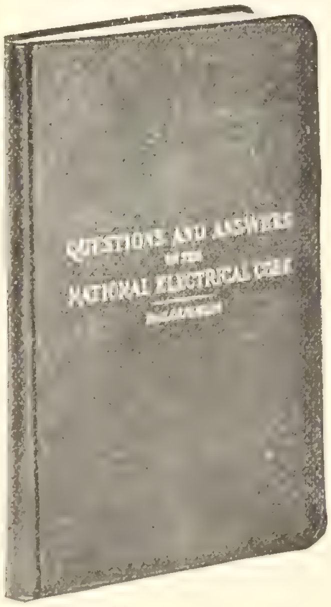

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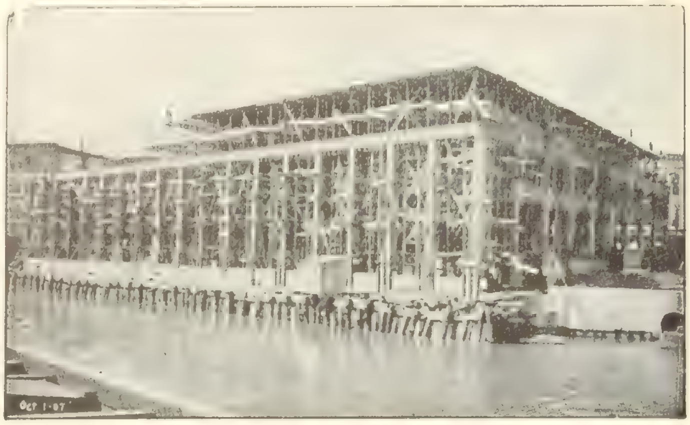

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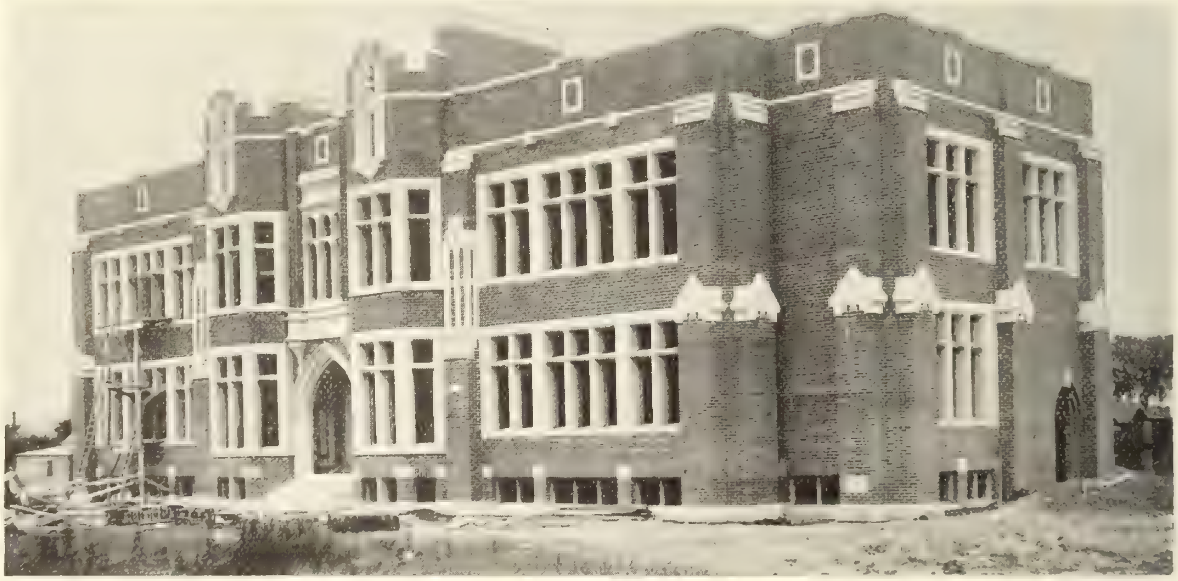

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Encouraging Records in the Field of Railway Building

JUST at the present time when pessimistic utterances are plentiful and so many doleful comparisons are being made, it is gratifying to turn our attention to the field of railway building whose activities during 1913 have easily constituted a record for this or any other country.

During the year 1913 the railways of Canada have had in hand, in one stage or another, fully 6,000 miles of new construction. By June 30 last, when the year for railway statistics closed, between 1,800 and 2,000 miles had been taken into operation as finally completed, and since that date there has been immense activity. Including lines which have been surveyed, lines for which the contracts have been let, and lines for which the contracts have been completed, the total will run into the extraordinary figure quoted. At present the Canadian Pacific has well over 1,000 miles in hand, the Canadian Northern not far short of 2,000, and the Grand Trunk Pacific about 1,000, while there also is to be considered the 500 miles of the Hudson Bay Railway and the National Transcontinental, which now is nearing its completion.

The Canadian Pacific Railway is in a more desirable financial position than many roads, as it has already received the necessary capital for its betterment and extensions. As a result its construction programme for the coming year will be of interest to contractors. This includes the continuation of the work started in 1913, and a number of new branch lines and extensions. The programme covers the double tracking between Sudbury and Port Arthur; between Port Arthur and Calgary, which calls for 1,095 miles of trackage; between Brandon and Calgary; the double track tunnel through the Selkirks; the double tracking between Revelstoke and Vancouver; a line between Sedgwick and Edmonton, 290 miles; two new lines from Bessano to a connection with Swift Current. In addition there is the Weymouth branch, running north of and parallel to the main line in Saskatchewan and Alberta to a connection with Alberta Railway south of Lethbridge—436 miles. There are also several other shorter lines ranging from twenty to one hundred miles in trackage, which are included in the programme.

Local Contractors and Labor

FOR its size—not geographically but considering the extent of its population—Canada is about as rich in examples of interesting contract awards as any community we ever read about in books. We do not wish to dilate upon the bad practices of our country but with the new year in sight there can be no harm in mentioning matters which may lead to good resolutions. We blush to recall many instances of bias and unfairness in the procedure of our public bodies, and although things are on the mend there is still plenty of room for improvement.

Upon this occasion we are inspired by a pithy editorial article in the columns of Engineering and Contracting. The observations made have a far wider application than they would appear to have. The principles apply generally to the stupid prejudice which some people entertain against outsiders. In its larger aspect the article constitutes a plea for the recognition of ability irrespective of local considerations, and it may be extended beyond contractors to the employment of engineers and architects. The employment of subterfuge in defence of a sound principle, which occurred in the "small Illinois city" to which reference is made below, is only justified where a community is of such agricultural density as to work for and expect to attain great developments within itself. To quote our contemporary:

"There was a time when some small cities in undertaking a municipal improvement went upon the principle of "let George do it," George, of course, being the local contractor. He lived in the town; he was a taxpayer; he was helping pay for the improvements; therefore he should be favored. Besides it would keep the money at home. As a consequence the city officials did not make much of an effort to reach outside contractors. The official advertisement was inserted in the local paper more as a matter of legal procedure than to make public the fact that bids were wanted on a piece of construction work. In a general way this served the purpose of restricting the bidding to George and a few others in that particular section of the country. Sometimes an outsider would get wind of the work and would submit a bid. Needless to say that he had to be quite a bit lower than the local man in order to get the contract. And even then he had to show a mighty good health certificate. To be sure he was the lowest bidder, but the city officials reserved the right to say whether he was the best bidder. To convince them of this it was almost necessary for the contractor to bring some of his previous work for actual inspection. But conditions have changed and most municipal officials now realize that only through broad competition can they secure the best terms obtainable. In country towns, however, there is still a strong tendency to keep the money at home by requiring the contractor to use local labor wherever possible. This requirement is set forth as follows in a recent specification for work in a small Illinois city:

> The contractor shall employ local labor so far as it may be practicable, and in all cases, local labor, either skilled or common, shall have preference, other things being equal.

This is an excellent example of skilful phrasing for handling a rather difficult proposition. It is fair to the city officials and to the contractor. The intent is that the latter shall use local labor "so far as it may be practicable, other things being equal." It does not bind him down to give employment to useless old codgers simply because they are residents of the city, nor does it require him to pay higher wages than he would give to imported labor."

Proposed Expenditure of Three Millions on Ottawa Pavements—An Interesting Report

THE cost of putting the streets of Ottawa in good condition provides groundwork for a particularly interesting and instructive report by Mr. Arch. Currie, the city engineer. The estimated cost of the improvements recommended by Mr. Currie is $3,172,119, apportioned (to the nearest dollar) as follows: asphalt, $502,298; asphalt macadam, $558,370; asphalt and stone blocks, $472,955; asphalt macadam stone blocks, $96,068; concrete, $39,420; macadam tar painted, $1,300,267; macadam tar painted and stone blocks, $5,073; macadam tar painted and granitoid, $23,756; stone blocks, $66,782; tar macadam, $107,122.

Mr. Currie goes into a detailed description of each type of roadway pointing out its advantages and its limitations. There are forty miles of asphalt pavement in Ottawa at present and the type is recommended by Mr. Currie as possessing the following good points: (a) Ease of traction; (b) Comparative noiselessness under traffic; (c) Imperviousness to water; (d) Ease of cleaning; (e) Pleasing appearance to the eye; (f) Suitability to all classes of traffic; (g) No vibration or concussion in travelling over it.

The point is emphasized that asphalt pavement should not be used on grades steeper than five per cent. The defects in this pavement are slipperiness, disintegration, a tendency to soften in extreme heat and crack in extreme cold, and unsuitability for steep grades. Asphalt macadam will be used on streets where the traffic is not so heavy.

Mr. Currie speaks favorably of concrete. The construction will be reinforced and transverse expansion joints about fifty feet apart will be provided. The painting of the surface of the road with some bituminous mixture and the subsequent sprinkling of sand are recommended as giving a good surface for a concrete pavement. Mr. Currie describes various other types and concludes by emphasizing the importance of maintenance.

Mr. Eugene W. Stern, the Secretary, and Mr. Alfred Noble, the President of the American Institute of Consulting Engineers (New York), have sent a formal letter to President Wilson asking that an experienced engineer be appointed to one of the vacancies on the Interstate Commerce Commission. It is pointed out that an engineer would have a special value as a member of such a body by virtue of his inside knowledge of transportation matters, particularly in regard to the physical valuation of railways, safety appliances, and the regulations of rates.

Effects of Salts on Strength of Concrete

TESTS to determine the effect of sodium chloride and calcium chloride, separately and together, upon 1:2:4 concrete were made at the University of Wisconsin during the winter and spring of 1912 by Messrs. H. E. Pulver and S. E. Johnson, instructors in mechanics. The test pieces were cured at temperatures of from 60 to 75 deg. Fahr. and below freezing. The results have been published in the "Wisconsin Engineer" by Mr. Pulver.

All mix was by volume and the salts were dissolved in the mixing water. The test pieces were 4-in. cubes, and those cured at a temperature below freezing were broken after fourteen and sixty days, while those cured at normal room temperatures were broken after fourteen, sixty and three hundred and sixty days. Four pieces were tested at each age for each batch of concrete. Atlas Portland cement was used, and to prevent variation in the quality it was mixed thoroughly in the beginning and a sufficient quantity stored in airtight cans.

The test curves show that as the percentage of NaCl is increased there is a nearly straight line decrease in the strength of the concrete cured under normal conditions. The effect of NaCl alone, when added to concrete cured at low temperature, is probably to reduce the freezing temperature, and hence retard the freezing of the concrete, thus permitting of its setting and hardening. The curves show an increase in strength for the addition of NaCl up to 12 per cent., after which there is a decrease. It may be that beyond 12 per cent. the weakening of the concrete due to the excess of NaCl more than offsets the strengthening due to the reduction of the freezing temperature.

When $CaCl_2$ alone is added to the concrete, cured either at normal or low temperatures, the effect is to increase the strength up to about 4 per cent. $CaCl_2$, at which point the maximum strength seems to be obtained. This increase in the strength of the concrete may be due to the acceleration of the setting of the cement by the $CaCl_2$. Serious disintegration was observed on the surfaces of the cubes cured at low temperatures with 6, 8 and 10 per cent. of the $CaCl_2$. This disintegration did not appear on any of the cubes cured at normal temperature or where NaCl was used.

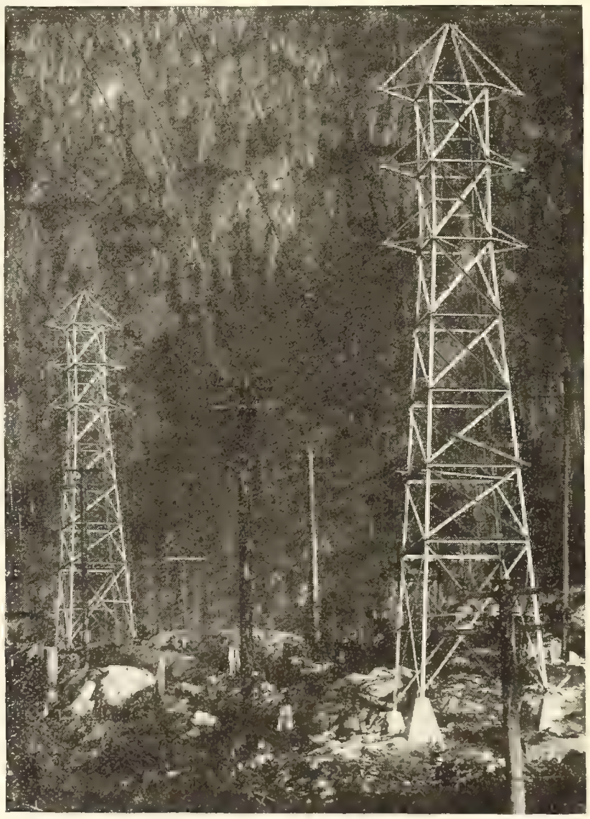
With concrete cured at low temperatures, the best effect seems to be obtained by using NaCl and $CaCl_2$ in the mixing water. It was noted that a 2 per cent. $CaCl_2$ and 9 per cent. NaCl mixture appears to give the most satisfactory results. For concrete cured at low temperatures this mixture gives about as much strength as any of the mixtures tried, and for the concrete cured normally there was not a very great reduction in strength due to the addition of the salts in those percentages.

All tests were made with only one brand of cement. It is probable that there would be some variation in the results with other brands, but it is not thought that this variation would be great enough to affect the general conclusions. It is also possible that some brands of common salt might contain a sufficiently high percentage of calcium sulphate to affect the results to some extent.

Constructional Features of Transmission Line Work in British Columbia

STARTING operations at sea-level and working to and over an elevation of 2,000 feet and then back again to sea level within the short distance of seven miles is a condition not often encountered in the building of transmission lines, Such, however, was the case in connection with the construction of the new transmission lines just completed for the Vancouver Power Company, a subsidiary concern of the British Columbia Electric Railway, by Mr. Tully R. Cornick, contracting engineer, of Vancouver. This company has heretofore been operating at 34,000 volts transmitted over wooden pole lines, but with the additional installation of 42,000 h.p. at No. 2 power house, situated below Lake Buntzen on the North Arm of Burrard Inlet, it was decided to increase the line voltage to 60,000 volts and utilize steel instead of wooden towers for transmission purposes wherever possible. The section of steel tower line just erected is seven miles in length, extending from No. 2 power house to Barnet crossing, the point at which the main transmission lines are strung across Burrard Inlet en route to Vancouver. The company's right-of-way between its main generating stations and Barnet is 100 feet in width and formerly carried two wooden pole lines of two circuits each, the pole lines each running twenty-five feet from the centre line. It was originally intended to construct the new tower line on the centre line, but this plan was later abandoned as impracticable on the ground that the angles would be too great for safety. The line, as finally built, crosses the old lines at several points, while at others it is directly over them. This form of construction necessitated a great deal of close work, in tower erection as well as in stringing of cables. The foundations of all towers are of concrete. Tie rods were first grouted in to the solid rock, and the forms and anchor bolts were placed and the concrete poured before any of the tower material had arrived from the factory. The towers stand 62 ft. 6 in. over all from foundation level, with the lower wire strung at approximately 40 ft. 6 in. from the ground. One 3/8-inch steel ground wire is carried at the apex of the towers. The distance between the conductors is seven feet, these consisting of two 3-phase circuits 000, semi-hard drawn seven strand hemp core copper cables. Standard O.B. suspension insulators and hardware are used throughout. There are sixty-three standard towers and two special towers. One of the latter, which is located at No. 2 power house, weighs approximately 5 tons; the other will be built for the Barnet crossing. The tower at Barnet will not be erected until next spring, the existing crossing facilities being utilized in the meantime.

Foundation work under difficulties. The precipitous bluffs upon which some of the steel towers were erected.



Two steel towers on the shore of Lake Buntzen. Densely-wooded country in the background.

Before proceeding to give a detailed account of the manner of erecting the towers, it may be as well to mention that although the actual distance from No. 2 power house (at sea level) to the level of Lake Buntzen is only half a mile, the land between these points rises to an elevation of 500 feet. The new transmission lines follow the shore of Lake Buntzen for a distance of 3 miles, at some points being only a few feet above lake level, while at others it is constructed at least 500 feet above the level of the water, this being due to the indented nature of the lake shore, crags and bluffs of great height occurring at frequent intervals. After leaving the southerly end of the lake, the line passes over a mountain known as The Summit, which has an elevation of 2,000 feet above sea level. From here it drops down to the North Arm side of the mountain and in the course of its windings towards the Barnet crossing, passes Deer Lake. This body of water stands at a height of approximately 200 feet above sea level and is about three-quarters of a mile in length.

An idea of the precipitous nature of the rocky bluffs upon which some of the steel towers were erected may be obtained from one of the photos reproduced herewith. The foundation forms as shown stand over 12 feet high, while the anchor bolts for the other two legs of the same tower are embedded in solid rock with no more of a concrete base than was necessary for levelling-off purposes. So difficult from the transportation standpoint was the mountainous country encountered that pack-horses had to be used for carrying the South African water bottles con taining water for concrete mixing.

The work on practically all of the foundations was rendered extremely difficult for the reason that it was impossible to blast on account of the direct proximity of the wooden pole transmission lines which were handling power for the city of Vancouver.

Method of moving camp during construction of new steel tower transmission lines for Vancouver Power Company, Limited.

One of the illustrations shows two steel towers on the shores of Lake Buntzen as well as the two wooden pole lines. The presence of the wooden cross arm and insulator supporting one of the live 34,000 volt cables will be noticed on the tower in the foreground. The background provides a striking illustration of the wild country encountered directly on the route.

On account of the uneven nature of the ground and the difference in the height of the piers, as well as the presence of the operating high tension lines, it was found absolutely necessary to construct every single steel tower in a vertical position, no space being available for assembling on the ground and erecting afterwards.

In addition to the steel tower line described above, the Vancouver Power Company has built and placed in operation a single circuit wooden pole tie-line between its power houses numbers 1 and 2, a distance of approximately 2,300 feet. This line carries one 60,000 volt three-phase circuit, as well as a ground wire on one end of the upper arm. This ground wire is used primarily as an equaliser, and secondarily as a ground wire. It should be mentioned that the present 60,000 volt cables on this line will be removed in the near future and placed upon a single circuit steel tower line running alongside the present wooden pole line. The latter line will then be used for carrying two 2200 volt circuits as well as the telephone lines between the power houses. The manner of constructing the base of the pole merits special mention. The entire stretch of ground between the power houses is composed of solid rock with a very thin layer of earth above. It was therefore considered more economical in the placing of these poles to drill a 2¼-inch hole into the rock and also a 2-inch hole into the butt of the pole, then grout into the rock a 4-foot piece of 2-inch round iron, 2 feet of which was in the pole and the other two feet embedded in the rock. Eight holes were then drilled for the same depth into the rock in a circle round the pole with a diameter of 18 inches. In these holes was placed reinforcement consisting of ⅝-inch round iron standing 2 ft. 6 in. above the level of the rock. Forms were then built these standing 3 ft. 6 in. square, and 5 ft. in height into which concrete was poured.

The greatest difficulty experienced in the construction of the steel tower line was that of transporting material. All of the steel required was carried along the route by the workmen employed on the contract, and the cement, gravel, sand and water for the concrete was packed in on horseback, as many as twenty-five horses being necessary. The different stages of transportation were as follows: Vancouver to the generating stations on the North Arm of Burrard Inlet by scows; generating stations to the level of Lake Buntzen over an inclined railway, thence along the lake on floats hauled by motor launches. From the lake shore onwards all material was carried by the workmen and on horse pack train. Both of the lakes mentioned in the course of the article were utilized not only for the transportation of material, but also for camp locations, in view of the fact that it was impossible to discover a level spot along the entire route of sufficient extent to even assemble a steel tower. Floats were built and boarded over and upon these the tents were erected, the floats being towed down the lakes by motor launches whenever it was found necessary to move camp. Transportation on the lakes was provided by three power launches, in addition to several row boats.

Mr. T. R. Cornick, who undertook the entire work in connection with the construction of this steel tower line, has had an interesting career. As field superintendent he handled the erection of the Mexican Light and Power Company's steel transmission line (170 miles of direct transmission) under Mr. R. F. Hayward, now general manager of the Western Canada Power Company, and later erected all the ground wire masts and cable on the same line as an independent contractor. This work was accomplished within a proximity of 30 inches to 60,000 volt hot cables. Coming to Vancouver at the inauguration of the development of the Western Canada Power Company's project at Stave Lake, Mr. Cornick built the entire steel tower high tension system for this company on independent contract work between the generating point at Stave Lake and Vancouver, a distance of 32 miles. The contract he has just completed forms the first section in the work of re-building the Vancouver Power Company's high tension lines between Lake Buntzen and Vancouver, in conjunction with the additional horse-power recently provided at the company's main generating station.

Large Dam of Hydraulic Fill Type at Lake Coquitlam, B. C.

THE great dam at the outlet of Lake Coquitlam on which the British Columbia Electric Railway Company has been at work since 1908 was completed recently and is now providing an ample water storage supply for the company's two power houses on the north arm of Burrard Inlet where hydraulic and generating units are now turning out 67,500 h.p. of electrical energy, with plans for further development, making a total output from the power station of 85,000 h.p.

The Lake Coquitlam dam was constructed under the direction of the chief engineer, Mr. G. R. G. Conway. The structure is of the hydraulic fill type, with very heavy rock toes on both the up-stream and down-stream side. The maximum height of the dam is 99 feet and its length along the crest is 850 feet, the width at this point being 40 feet. The down-stream slope of the dam is 2 to 1 at the crest, 3 to 1 at a lower elevation and 4 to 1 from this point to the toe. On the up-stream side the slope is 5 to 1 and 1½ to 1. Both slopes are covered with rip-rap three feet thick. On account of these gradual slopes the total volume of the dam is very large, 530,000 cubic yards of material being employed in its construction. Of this amount 132,600 cubic yards is rock used in the toe walls in riprap. The remainder of the dam is of the hydraulic fill type, this material being almost entirely sluiced from the high hills on either side of the dam through flumes extending across the line of structure.

The work of sluicing was done by a large number of hydraulic monitors. The material is of a fine blue glacial clay, interspersed with boulders. This material when sluiced into the dam makes a perfect fill and the dam as it now stands is as solid and enduring as any dam on the continent.

During the construction of the dam the flow from the lake was diverted through a tunnel driven through the rock just east of the dam. This tunnel is 490 feet in length and has a sectional area of 400 square feet. Now that the dam is completed this tunnel is closed, but provision is made where this service may be separated in cases of emergency.

The spillway of the dam is about 15 feet below the crest and has a width of 250 feet. The capacity of the spillway is 12,000 cubic feet per second when the water is 7 feet deep over the sill. The plans for the spillway provide for its carrying three times the maximum flow from the Lake according to records of recent years.

Coquitlam Dam. Water running over spillway for first time.

The new dam raises the lake level 60 feet and increases the storage capacity by 162,000 acre feet. The total capacity of the reservoir behind the dam is 175,600 acre feet, or 7,560,000,000 cubic feet.

The larger illustration is a general view of the dam practically completed. The gradual slopes on both the up-stream and down-stream side make the construction appear far smaller than would be expected in a dam having a maximum height of 99 feet.

General view of Coquitlam dam nearing completion.

A record in output has been established, it is claimed, by the travelling plant which is making the concrete blocks for facing the Kinsico Dam of the Catskill Aqueduct at Valhalla, N.Y. The concreting tower is carried on railroad trucks, and traverses three rows of Blaw-steel forms in which 4,200 blocks per month are cast, equivalent to about 5,000 yd. of concrete. The concrete is delivered from the mixers directly into the forms. No buckets or derricks are employed. A large number of blocks have already been manufactured and are piled up, many tiers high, adjacent to the casting yard to season before being placed in the structure. An important advantage of the plant is said to be the elimination of concrete buckets and the direct delivery of the concrete.

Experiments have been made to determine the availability of concrete for oil storage tanks and it was found that the material was entirely suited for the purpose. Accordingly a number of them have been built at El Paso, Texas, by one of the railroad companies of that section which is engaged in extensively handling oil from the fields of that state. Up to this time it was generally agreed that the presence of oil had some serious effect on the concrete.

Design and Construction of a Reinforced Concrete Elevated Water Tank at Park Hill, Ont.

DURING April, May and June of the present year there was built, at Park Hill, Ont., an elevated reinforced concrete water tank of 100,000 Imp. gals. capacity. This tank, for the description of which we are indebted to our Chicago contemporary, Engineering and Contracting, is supported on a cylindrical shell which is 71 ft. 6 ins. high, 23 ft. in inside diameter and with 9-in. walls. The tank bottom is a reinforced concrete disk 29 ft. 4 ins. in diameter and 18 ins. thick. The overhang of this bottom beyond the outer surface of the supporting shell is 2 ft. 5 ins. The design at this point led to the adoption of an interesting construction method which is later described. The tank proper is a cylindrical shell 27 ft. in internal diameter, 29 ft. high, and with 8-in. walls. This shell is surmounted by the tank roof, which is a portion of a spherical surface of 35 ft. 1 in. radius. The roof is uniformly 4 ins. thick. The foundation ring is trapezoidal in cross section, the bases of the trapezoid being 6 ft. 6 ins. and 1 ft. 3 ins. respectively. The bottom of the foundation was placed 4 ft. below the finished grade of the surrounding soil.

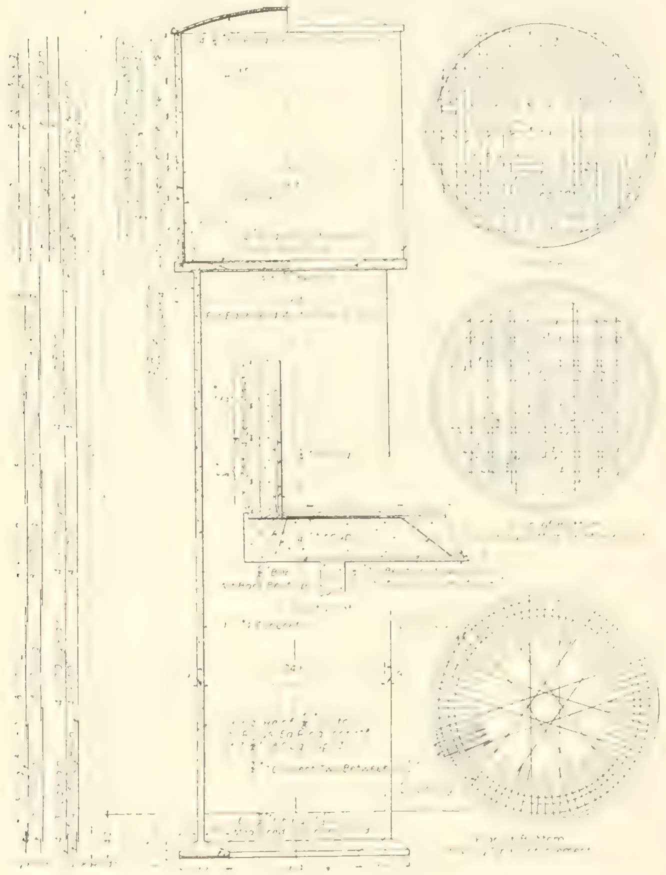


Fig. 1.—Sectional elevation and cross section of reinforced concrete water tank at Park Hill.

The reinforcement used is clearly indicated in amount, size and position by the elevation and sectional views shown in Fig. 1. The amount of the reinforcement may be summarized briefly as follows: Footing, 1,040 ft. of ⅝-in. round rods; supporting shell, 2,048 ft. of 1-in. round rods and 4,284 ft. of ⅝-in. square rods; bottom, 2,982 ft. of ⅝-in. square rods, 1,120 ft. of ⅜-in. round rods, and 480 ft. of ¼-in. round rods; tank wall, 272 ft. of 1-in. round rods, 2,871 ft. of ¾-in. square bars, and 2,871 ft. of ⅝-in. square bars; roof, 396 ft. of ⅝-in. square rods and 1,326 ft. of ⅜-in. round rods; bottom, 94 ft. of 1-in. round rods.

The supporting shell is used also to house a booster pumping unit. The shell is provided with windows and a door. The ladder to the tank extends upward outside the shell. This was practicable on the Park Hill tank because of the small overhang of the tank proper beyond the cylindrical supporting shell.

It will be noted that where water is in contact with the concrete the mixture used was 1:1:2. In all other parts of the tank a 1:2:4 concrete was used.

A construction view of the tank is shown in Fig. 2. The concreting plant consisted of a Chain Belt mixer, a hoisting tower, hoisting engine, two hoisting platform cages, and ordinary wheelbarrows. The barrows were placed on the cages with their handles toward the tank. Since the tower was only a foot or two from the nearest part of the tank or supporting shell at any time, it was an easy matter for laborers, standing on the working platform within and at the top of the tank walls at any stage of the construction, to reach across to the hoisting tower and grasp the handles of the wheelbarrow. A short piece of plank extended from the hoisting cage to the working platform to provide a bridge upon which to roll the wheelbarrow.

The method of manipulating the forms on the lower shell is indicated in Fig. 2. The forms were suspended from 1-in. rods which were imbedded in the concrete and spaced 9 ft. 6 ins. apart circumferentially. These rods formed the support for a hollow screw which on being turned, raised the forms. The hoisting tower used was 112 ft. high and was divided into 7-ft. panels. The tower posts, four in number, were 4 x 4 ins. in section. There was horizontal bracing at the top of each panel, of 2 x 4 in. or 2 x 6 in. stuff, and there was a 2 x 6 in. diagonal brace in each panel.

A running board on the inside of the shell was always at the same level as that occupied by the one outside the shell as shown in Fig. 2. In addition to these running boards a working platform, previously mentioned, on the inside of the shell, supported on trusses, was attached to the jack frames in such a manner as always to be flush with the top of the wall forms.

The main form for the tank bottom was supported by a set of forms built up within the supporting shell. This form-work consisted essentially of 6 columns, each 6 x 6 ins., in section. These columns were symmetrically disposed at the corners and in the middle of the long sides of an 8 x 12 ft. rectangle. These main verticals were braced both horizontallyand diagonally in each 10-ft. panel. At the top of the supporting framework three parallel lines of 3 x 12-in. plank were placed horizontally across the tops of the six 6 x 6-in. verticals. On top of the 3 x 12-in. plank 2 x 6-in. plank were laid to form a floor which, in turn,

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[*] In our issue of April 30, 1913, we published an article (by Mr. A. W. Connor,) descriptive of a large reinforced concrete water tower at Berlin, Ont. Our contemporary, Engineering and Contracting, comments upon the fact that the Park Hill tank is similar to this structure, with one important exception, namely, the use of a flat bottom for the tank instead of the dome and frustrum type of bottom which was adopted at Berlin.

was covered with ⅞-in. sheeting. Upon this sheeting platform the concrete tank bottom was poured, after the brackets and slabs later mentioned were in place. The diameter of this platform was 23 ft.; the inside diameter of the supporting shell. Since this did not provide for the overhang of the tank bottom the following method was devised to handle the concreting at the junction of the tank bottom with the two shells.

A series of separately cast but permanent reinforced concrete brackets and slabs was utilized for the purpose of supporting the overhang of the tank bottom and, of course, to partially support the tank wall forms and the walls themselves. This saved the expense of a complicated set of bracing to extend from the ground to the tank bottom. The details of this construction are as follows:

Twenty-six 1-in. gas pipes were placed in the walls of the supporting shell, at 3 ins. below its top, at intervals of about 3 ft. circumferentially. About 2½ ft. below this row of gas pipes there was placed an exactly similar row. Bolts built into the reinforced concrete brackets were passed through the gas pipes and tightened up in that position by nuts turned on the bolts from inside the supporting shell. After the brackets were placed in this manner the gas pipes were filled with mortar around the bolts. The ready-made reinforced concrete slabs were then placed upon the brackets and the concrete of the floor of the tank was poured upon these slabs and the platform previously described. The form work and concreting of the walls of the tank were then proceeded with.

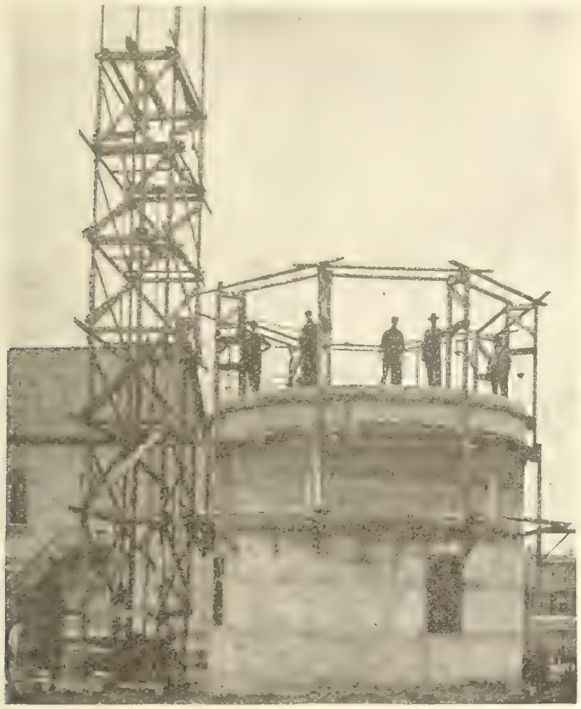


Fig. 2.—Constructional view of Park Hill tank.

The brackets are of approximately triangular shape in side elevation, being 2 ft. 3 ins. on the top of the triangle and 7 ins. at the bottom. They are 2 ft. 11 ins. high and are 4 ins. thick. In plan the slabs are sections of a circular ring. They are 2 ft. 4¼ ins. wide and 3 ft. 6¼ ins. long on the outside edge. They are 2 ins. thick. Both slabs and brackets are made of 1 :1 :2 concrete.

The tank here described was designed and built by Mr. L. J. Mensch, Mem. Am. Soc. of C. E., general contractor, Chicago, Ill., at a contract cost of $6,000.

Army Engineers Build Bridge by Hand Labor at North Vancouver, B. C.

THE Third Fortress Company of the Royal Canadian Engineers recently spent six weeks in field practice in the neighborhood of North Vancouver, B.C., in the course of which a structure designated as the Claxton-Fiddle inverted, rigid-suspension bridge was constructed in twenty-eight hours by a force totalling fourteen men. The work is described in the Engineering Record. The structure had a span of 92 ft. and was designed to carry a total, uniformly distributed load of 14 tons. Two pairs of 20-ton cable were used to support a floor system of timber which was braced and guyed so as to give it a high degree of rigidity; 3,000 ft. b.m. of cut lumber were used, in addition to the vertical supports and their braces.

The most arduous part of the work was the digging of the trenches to hold the anchorages of the wire cables which carry the load. These were sunk 18 ft. deep at right angles of the two main cable lines, and in them were buried logs 14 to 16 ft. long and 15 in. in diameter. From these trenches inclines were excavated to carry the cables on a straight line from the anchorages to the cross-bar supported on uprights extending 14 ft. above the bridge floor at either end of the structure. The lower ends of the uprights supporting these cross-bars were sunk in holes dug for the purpose, and were braced in two directions by timber struts attached to the uprights well above the bridge floor. Care was taken to brace these uprights firmly in a vertical position so that the strain from the cables would be transferred direct to the ground.

A movable transom was slung from the main cables and was used to place the vertical tie cables, from which, in turn, the floor system was extended out from either bank. Operations proceeded simultaneously from both banks until the span beams met at the center, at which point they were lashed together by rope.

The work was carried out under the personal direction of Maj. A. B. Carey, R.E.

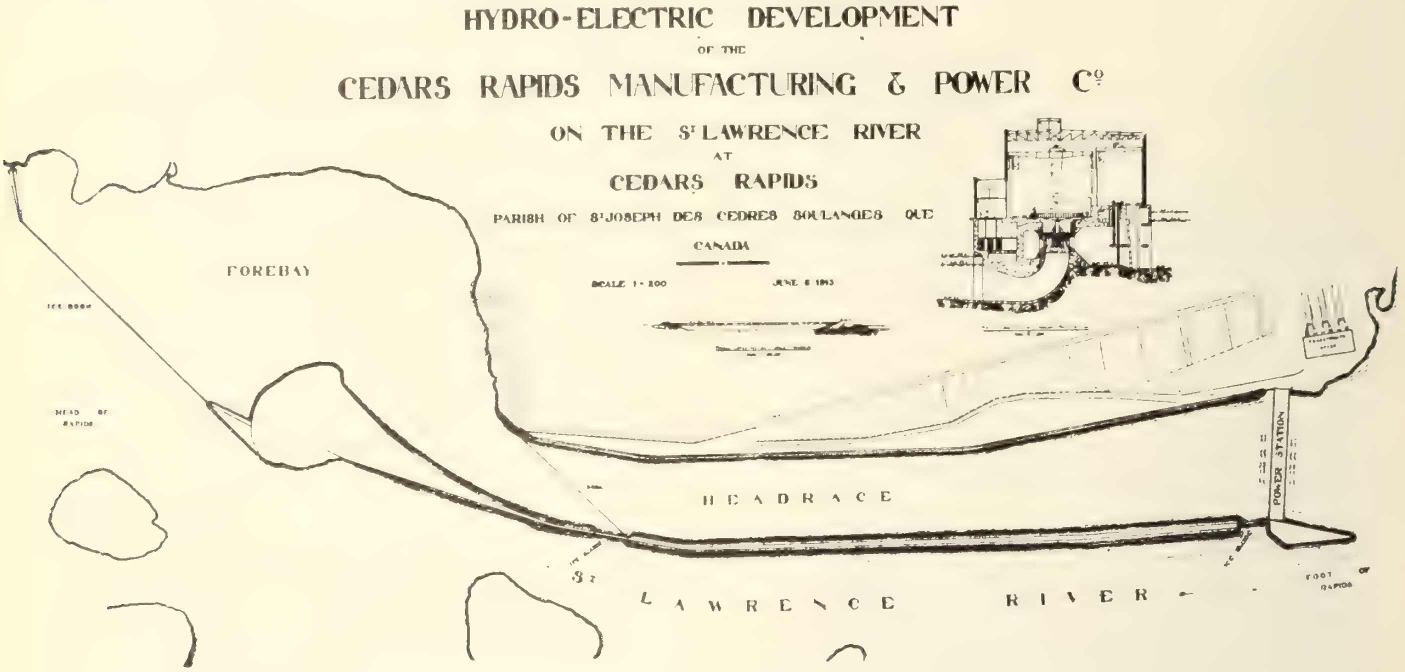
Electrolysis of water pipes in Seattle, Wash., has caused much damage, it is reported, especially in the case of wood-stave pipe wrapped with continuous steel wire. Wood-stave pipes have been laid in some of the city's streets largely because of the rapid growth in population and the consequent temporary nature of the water-distribution system. The service pipes from the mains to the buildings and the steel-riveted pipe are also affected a great deal. Cast-iron pipes are subject to the same action, but owing to the larger volume of metal they do not deteriorate as rapidly as the other kinds. In the vicinity of street railway sub-stations the deterioration has been much more rapid than elsewhere, often resulting in the complete destruction of the bands, and even the disintegration of large cast-iron pipes.

To clean painted walls, advises an exchange, dissolve two ounces of borax in two quarts of water and add one tablespoonful of ammonia. Use half this quantity to each bucket of water. Do not use soap. Wash a small amount of paint at a time and rub dry with a clean cloth.

Hydro-Electric Development at Cedars Rapids, Que.

Progress Report

The Cedars Rapids Manufacturing and Power Company are carrying out, through Messrs. Fraser, Brace and Company, the contractors, the most important hydro-electric development in the neighbourhood of Montreal. The map, together with the cross-section of the powerhouse, shows the general arrangement of the plant. The water is taken in above the Cedars Rapids between the island, forming the upper part of the dam and the main shore. The canal extends from this island to the power house, a distance of about 12,000 feet, which forms a dam at the end of the canal, concentrating at that point the fall of 30 feet. In the power house are to be installed vertical waterwheels, each of about 10,000 h.p. capacity.



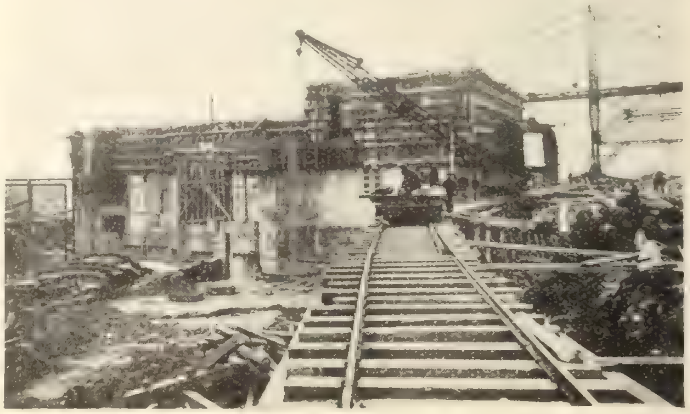
The water passes through the screen or racks at the up-stream face of the power house into the flume or casing of the waterwheel, the casing being constructed of reinforced concrete. Passing along the casing the water enters the wheel, presses against the vanes of the wheel, and discharges through the centre through the draft tube, thus out to the tailrace and down the river below the rapids. The generator will be mounted immediately above the waterwheel. The weight of the rotating part will be carried on a thrust-bearing located on the top of the generator.

The transformer house is located on a hill above the power house at a distance of about 300 feet. It is being constructed to take care of 100,000 h.p. The power-house foundations are of concrete. Work is proceeding on the erection of the steel frame work and the super-structure, a cantilever crane being used for placing the concrete. By the method of construction the power house building is made up of reinforced concrete units, which at the present time are about two-thirds completed. During the winter, and as rapidly as the foundation work will permit, the steel work will be assembled and these units or slabs put into place, so that the erection work on the waterwheels can go forward without delay.

A dyke extending from Isle-aux-Vaches to an earth bank known as the south bank is being constructed. This earth dyke extends a distance of about 12,000 feet from the Isle-aux-Vaches to the power house. The upper end of it about 2,000 feet long, is being built across a bay of the river. A thin earth bank is being retained at the present time to act as a coffer dam, so that the main canal excavations are carried on with steam shovels in the dry ground.

The turbine units are being constructed by the I.

Transformer-house foundation.



Power-house substructure.

P. Morris Company, of Philadelphia, and Wellman-Seaver-Morgan Company, of Cleveland, Ohio. The first three turbine units have already been delivered at Cedars, and about January 1st, 1914, the work of erection will be commenced. The electrical generators, of which nine will be installed, are being constructed by the General Electric Company, of Schenectady, N.Y.

Instructive Paper on Stave Falls Development

HYDRO-ELECTRIC development at Stave Falls, B.C., the project of the Western Canada Power Company, Limited, was the subject of an interesting paper by Mr. R. F. Hayward, general manager of the above company, presented at a recent meeting of the Vancouver branch of the Canadian Society of Civil Engineers.

The paper, which was illustrated by a number of lantern slides, described the design and construction of the power plant which is now in operation at Stave Falls, gave a general outline of the proposed additional developments on the Stave River, which will ultimately bring the capacity of the plants to 120,000 horse-power, and dealt very fully with the question of water supply and the most economical development that could be made under the physical conditions which obtain in the Stave Valley. The existing plant is designed for four 13,000 h.p. units, two of which are now in operation, with two additional ones on order.

The development consists of a heavy concrete intake dam, about 60 feet high, which is to be raised in the course of the coming year another 20 feet; a sluice dam consisting of piers closed by removable stop logs; a reinforced concrete power house on a foundation excavated out of solid rock, and a tailrace about 1,500 feet long excavated to a depth of about 30 feet.

The power house is now operating under 100 ft. head. When the dam is completed to its full height it will operate under a maximum head of 120 feet.

Alternative Plans

From the tailrace of the existing plant to the mouth of the Stave River there is available for further development, a fall of 130 feet. Two plans of developing this fall are now under investigation: the first contemplates the whole development at one place and involves the construction of a dam 165 feet high in a rock gorge at the mouth of the river, and the second provides for two power-houses, each operating under 65 ft. head, one to be built at the mouth of the river, and the other about one mile below the existing plant at Stave Falls. On account of the great saving that can be made in the cost of dams, the two low head plants will probably prove the most economical development.

Stave Lake lies to the north of the Fraser River, about 35 miles east of Vancouver. The watershed, which is only partly explored, has an area of about 450 square miles. It is formed by the granite mountains of the Coast Range, which rise to elevations of over 8,000 feet and carry perpetual snow. The river, from its source in a large glacier to the mouth at the Fraser River, is about sixty miles. The lake has an area of about 12 square miles and lies at an altitude of 230 feet above sea level. There is a fall of only 14 feet in seven miles of the river from the foot of the lake to Stave Falls. There it drops about 80 feet and flows thence in a series of rapids to its tidal mouth at Ruskin, on the Fraser River.

The annual rainfall, taken over a period of the last twenty years in the vicinity of Stave Falls, has averaged 77.5 inches, with a minimum year of 50 inches and a maximum year of 90 inches. The average precipitation over the drainage area is unknown, as Stave Falls is the only point at which the rain gauge has been established. Stream measurements have been taken continuously for nearly six years. The mean annual run-off of the river is approximately 4,000 cu. ft. per second, and the lowest mean annual run-off was 3,400 cu. ft. per second.

The ratio of run-off to the precipitation, as measured at Stave Falls, is 1.6, which indicates that the average precipitation over the whole basin is probably twice the precipitation at Stave Falls.

The maximum flood discharge that has been measured in the natural state of the river is about 36,000 second feet, but if the controlling action of the lake were eliminated the actual maximum flood run-off would be nearly 60,000 c.f.s., and this is the amount which must be taken into account in calculating the design of spillways.

It is practicable to build a dam at Stave Falls to raise the water 40 feet above its low level, thus increasing the area of the lake for storage purposes from 12 to 24 square miles.

Mass curves of the run-off have been plotted for the past six years and the following series of curves was computed to determine the most economical development that could be carried out, viz.:—

1. A curve showing mean flow available for varying height of dam.
2. A curve showing mean head available for varying height of dam.
3. A curve showing mean power available for varying height of dam.
4. A curve showing cost of increasing height of dams to store water 30, 35 and 40 feet above low lake level.

From these curves the maximum available power on a sixty per cent. load factor, with turbine efficiency of 83 per cent., is worked out as follows:—

1. For dam to start water 30 feet above low level—52,000 h.p.
2. For dam to store water 35 feet above low level—59,000 h.p.
3. For dam to store water 40 feet above low level—64,000 h.p.

The cost of increasing the dams above the 30 ft. level worked out as follows:—

From 30 to 35 ft. level	$20.00 per h.p.
From 35 to 40 ft. level	$25.00 per h.p.

Beyond this limit the cost per h.p. increases very rapidly.

The power-house was designed to operate under a maximum head of 120 feet, a minimum of 100 and a mean of about 110. It was laid out for four 13,000 h.p. units.

The turbines, which are horizontal type double Francis wheels with central discharge, running at 225 revolutions, were built by Escher Wyss & Company, of

Zurich; and the 9,000 kv.a. generators were built by the Canadian General Electric Company.

The intake dam is founded upon solid rock and is built of concrete, heavily reinforced at certain parts. There are four main intake gates of the radial type, each gate closing an opening 20 feet square under a maximum head of 45 feet. Each penstock is 14 ft. 6 in. in diameter and about 150 ft. long. The powerhouse foundation is excavated out of solid rock and the building is a heavily reinforced concrete structure.

The mechanical and electrical features of the plant have been very fully described in the various techical journals and, therefore, were not discussed to any extent in this paper.

Pavement Construction with Bricks Laid Flatwise or with the Fibre in a Vertical Position

By James T. Tucker[*]

A brick pavement varying in several important particulars from the usual standards, was laid at Norman, Oklahoma, seat of the State University, during the present season. In December, 1912, the Western Paving Brick Manufacturers' Association, Kansas City, Mo., after extended consideration, resolved to substantially modify the specifications under which it would recommend pavement construction. The Norman pavement is a good example of the new type proposed. The chief advantages claimed and expected for this pavement are three in number.

The first difference relates to putting the fibre of the brick in a vertical position in the pavement. Experiments with an augur machine prove conclusively that as the clay column is forced through the die of the augur machine, there is a well-pronounced arrangement of the plastic material in concentric layers. This arrangement of material is closely represented by the fibre in wood. The clay column is cut into blocks by wire in the usual fashion, but instead of being passed to the repressing machine, the green blocks are immediately passed to the dryers and thence into the kilns. The augur machine expends perhaps 75 h.p. of energy in compressing the material and building up the fibrous structure just mentioned. These blocks are ordinarily passed to the repressing machine where the moveable sides of the die bring a heavy pressure to bear on the six surfaces of the block, effectually upsetting or breaking down the fibrous structure previously obtained besides expending a considerable amount of energy to undo what the augur machine has just done.

Other differences are that the repressed brick has smoother surfaces, is habitually given rounded edges, and usually carries the maker's name. The new style of block is purposely left as square-edged as the process of manufacture will permit, is cut by a coarse wire with a view to producing a roughened surface, and therefore has only the four smooth surface given by the sides of the die in the augur machine. It has been common practice to so proportion the repressed brick that each brick went into the pavement lying on its side so far as the fibre was concerned, though on edge as to size, the effect being as though wood paving blocks were laid with their grain parallel to the direction of traffic, instead of having it vertical. On the hypothesis of a fibrous structure it appears that the resistance to wear should be much greater if the fibres are placed vertically in the pavement instead of lying flat since the tendency to spall or break is thereby greatly lessened. The vertical-fibre method of laying brick is now carried out. The dimensions of the brick are 8¼ x 3½ x 3 ins., and they are laid flatwise; i.e., with the 3-in. dimension vertical.

From the manufacturer's standpoint, there is a considerable saving of material due to lessening the pavement thickness. Also as the bricks have their larger dimensions flatwise, a less number of bricks is required to the square yard and substantial savings may be thereby made, while the consequent lessening of cost tends to popularize brick paving. Also the cost of power required to operate the repressing machine is saved, as well as the extra handling required to put the brick through it.

The second important variation deals with the problem of a suitable joint filler. Brick makers in this southwestern country have, for a considerable time, looked upon the sun as the worst enemy of their pavements when the specifications of the National Association calling for a cement grout filler have been followed. The frequent presence of cracks in different grouted pavements was often attributed to carelessness or want of taking pains on the part of the contractor. Also, the subgrade was often assumed to have been either improperly drained or not sufficiently rolled whereupon surface cracks were said to appear. Investigations carried on by the U. S. Bureau of Standards to determine the amount of pavement expansion due to varations in temperature, together with extended local observations forced these brick makers to the conclusion that the strong cement grout filler promoted the setting up of severe shearing and crushing stresses, and tended to eventually destroy the pavement, instead of being an element of inherent strength as it is generally assumed to be.

The trend of reasoning in this section of the country, therefore, is toward separating the functions of the foundation and the pavement surface. In other words, it is felt that the aim should not be to make a pavement sufficiently strong in its wearing surface to enable it to do its own work and that of the foundation as well. Sound design evidently calls for a good sub-grade and a strong foundation such as concrete, possibly reinforced, whose function is primarily to distribute loads. But the wearing surface must be fundamentally designed to resist wear and abrasion, a purpose distinctly different from that of distributing loads. Pursuing this line of reasoning the need for a cement grout filler is not apparent and by omitting it, troublesome and disastrous cracks can be avoided. It should not be assumed, however, that any sort of bituminous filler will suffice, since evidently this is not so, but if a good grade of asphalt with a relatively high melting point is used the filler should be absolutely permanent. As each and every brick is surrounded by a complete expansion joint, plainly more than sufficient for each individual's requirement, it follows that there can be no cumulative effects of expansion which have proved so disastrous to many brick pavements.

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[*] Director, School of Civil Engineering, University of Oklahoma, Nebraska, Okla.

The third advantage in the use of asphalt filler is its noiselessness. Noise has been one of the principal arguments against the old style of brick pavement. The surface of the new type of brick purposely made rough in manufacture, engages whatever asphalt falls upon the surface, prevents it from being pulled up by traffic and effectually cushions the flat surfaces. In applying the filler, therefore, no effort is made to pour the joint lines, which is a tedious and costly process, but the asphalt is heated to a suitable degree of fluidity, is leave a thin squeegee coat over the entire pavement. The object is to fill each and every joint full and to then cast upon the pavement with buckets and immediately spread by hot steel, hoe-shaped scraping plates. This quickly cools, and a generous sprinkling of coarse sharp sand is thrown over the surface, when the street is immediately ready for traffic.

A further important element of noiselessness is found in the square edges of the new vertical fibre blocks, since the joint depressions which in general quickly come between the brick in a grouted pavement are here entirely missing. Some care is, of course, necessary in gauging the quantity of asphalt to be used, since if too small, the joints are not completely filled and the depressions between the courses become very pronounced. On the other hand, with an excess quantity of a material such as Sarco filler, its ductility after cooling is such that the sanded surface readily slips upon the surface in contact with the top of the brick, gives a poor foothold for horses, and further exposes a fresh asphaltic surface, which may be tracked into houses, etc.

This pavement when completed shows a still further advantage over any other pavement, even sheet asphalt, in the regularity and smoothness of its wearing surface. This is because it is a relatively simple matter to screed the cushion coat of sand to a smooth surface, and a uniform density. When the brick are laid upon it and well rolled, a surface, true and regular in grade and cross section, is readily obtained. With a sheet asphalt surface, however, it does not seem possible to obtain so true a grade and cross section. The laborers who spread the hot asphaltic aggregate from the heaps into which it is dumped as it comes from the mixing plant are unable to gauge accurately the density of the aggregate after it has been shovelled or raked into place. In preparing for the roller they leave the surface as smooth and regular as is practical, but the roller quickly detects the spots of less density. The depressions thus formed may not be extensive, but on a street having a slight grade their presence is plainly shown by the appearance of shallow pools of water standing after heavy rain. These depressions are also plainly to be felt while riding in an automobile at greater than the most moderate speeds, while no variation of speed detect similar holes in the brick pavement.

The brick for the pavement at Norman were furnished by the Francis Vitric Brick Company, of Boynton, Ohio, and each car was tested on the "1911 Rattler" at the University, passing a rattler test of 24 per cent., with no allowance for the square edges. About 11,000 square yards in all have been laid here.

One piece of pavement about 1,800 ft. long by 30 ft. wide abuts the University property and half its cost was borne by the State. The School of Civil Engineering at the University was responsible for all the testing and the inspection of the state work and prepared the specifications for it. The director of the school also took an active interest in securing the adoption of this type of pavement on other streets, believing thoroughly in the merit of the new principles which this pavement exemplifies.

The pavement already built has created so favorable an impression among the townspeople that it is probable more will be laid in the near future. The contractor for this work was the Connelly Construction Company, of El Reno, Okla., and the contract price with a 4-in. concrete base was $2.10 per square yard. There are no local concrete materials, sand and stone being shipped in about sixty miles, and cement costs approximately $1.75 per barrel.—Engineering & Contracting.

New Plant of the Paris Brick and Clay Products Company

THE new plant of the Paris Brick and Clay Products Company is situated in Paris, Ont., on the right side of the Nith River, just above the point where it enters the Grand River. The plant is located about half-way up the bank. In order to secure a level position it was found necessary to excavate some of the ground on the steep bank of the river. This necessitated a considerable amount of labor, which was completed in the fall of 1912. In the spring of the present year the plant had been built and put into operation, with the result that brick-making has been in full progress during the summer months.

The machinery and driers are situated ten feet above the kiln ground, thus making it possible to set the brick as high as the checker in the kiln. Then, planking the whole kiln above the checker, the setting is finished 32 high without tossing. This is a great advantage in the working of the plant, as it cuts down considerably the expense of setting. The plant is turning out wire-cut brick exclusively—both end and side cut—the brick being of the most peculiar shade of light red with white spots scattered over the face. It is sound and hard, with good square corners. The clay is such that the cut, except on close examination, can scarcely be noticed. The brick is of a very close nature and is so high grade that it can hardly be distinguished from a dry press brick. The machinery in the plant consists of one 60 h.p. gas engine, the gas being piped into the plant from the wells of the Domniion Gas Company in the neighborhood of Dunnville. The machinery complete was supplied by Bechtels, Limited, Waterloo, Ont. It consists of two steel cars into which the clay is loaded by hand directly behind the machine head. These are hauled up to the plant by a Bechtel double friction hoist. The contents of the car are then dumped into a Bechtel 10 x 24 pug mill, then through one of their barred roll disintegrators into another pug mill of equal capacity. The brick machine is a Bechtel No. 5, to which is attached a No. 15 automatic end cutter. A certain proportion of brick are made side-cut by using a revolving hand side cutting table. After leaving the cutting tables they are placed upon Bechtel trucks and conveyed to the open-air drying sheds. The brick are at present being burned in open kilns, but it is the intention of the company to erect a down-draft kiln of the double rectangular type in the near future, thus making the plant thoroughly up-to-date in every respect. The capacity of the plant is from 25,000 to 40,000 brick a day.

The fact that a satisfactory output is being maintained daily is a good augury for the future success of the company.

Early Piledrivers

THE piledriver has always been one of the most important machines in civil-engineering construction, as piles were the only (or at least principal) means of securing reliable foundation in soft ground, until a recent epoch. The present-day contractor may well wonder how his predecessors before the time of the steam engine carried out their pile-driving jobs. Engineering News has compiled some sketches from models and old drawings in the great German technological museum at Munich (Deutsches Museum), which give a fairly comprehensive idea of old pile-driving machines.

To begin with very primitive methods: Driving with a maul is shown in the small sketch at the upper left corner of Fig. 1. Below is a machine for the same purpose that may be called a hand-operated machine maul; it was adaptable to inclined piles. The problem of driving batter piles was, in fact, of great concern to the old builders, as considerations of stability often demanded such piles. Another primitive device, lacking the idea of a machine, is the one sketched at the top middle in Fig. 1; it is interesting as presenting the ram idea in most simple form. A guide rod or bolt driven into the top of the pile served as guide for the ram, which had a hole in it to slip over this rod.

The three sketches just referred to are from a mediaeval work on construction. Probably they represent devices which even then were only of historical importance, for the same work sketches the machine pile-driving ram at top right in Fig. 1. Here the essential elements of the piledriving machine are present; a pair of leads, a ram moving between them, a hoist rope led over a pulley at the top, and a winch for hoisting. In this case a ratchet winch is used, so that one man can lift the ram. It is not apparent how the ram was released; possibly it was released simply by throwing out the ratchet pawl.

The machine of doubtless most extensive use until relatively recent time is the rapid-stroke gang driver shown in the lower right corner of Fig. 1, sketched from a model in the museum. Here the tail of the hoist rope was fitted with grips for eight or ten men, who by pulling and letting go could give a fairly rapid series of short blows. The base frame of the driver was fitted for inclining the leads by setting back the rear brace legs in slots of the base as shown.

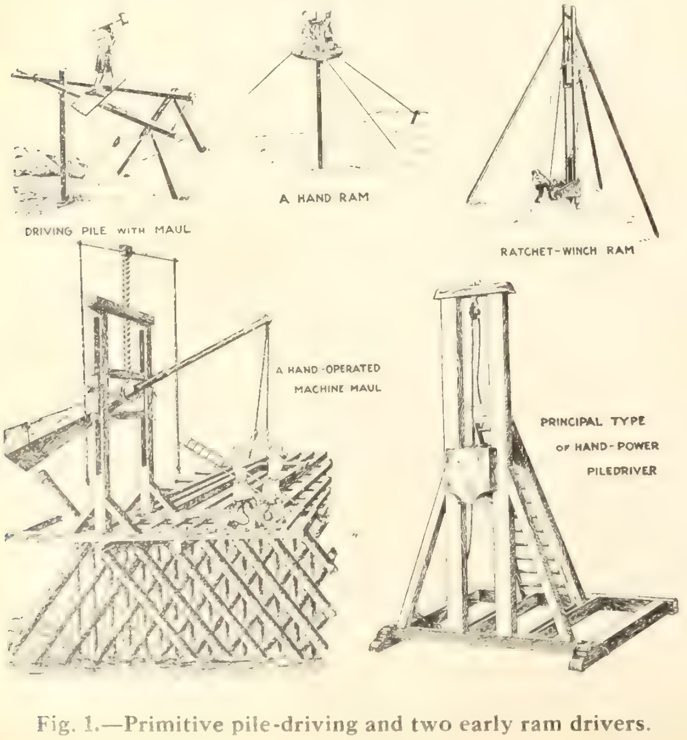

DRIVING PILE WITH MAUL
A HAND RAM
RATCHET-WINCH RAM
A HAND-OPERATED MACHINE MAUL
PRINCIPAL TYPE OF HAND-POWER PILEDRIVER

Fig. 1.—Primitive pile-driving and two early ram drivers.

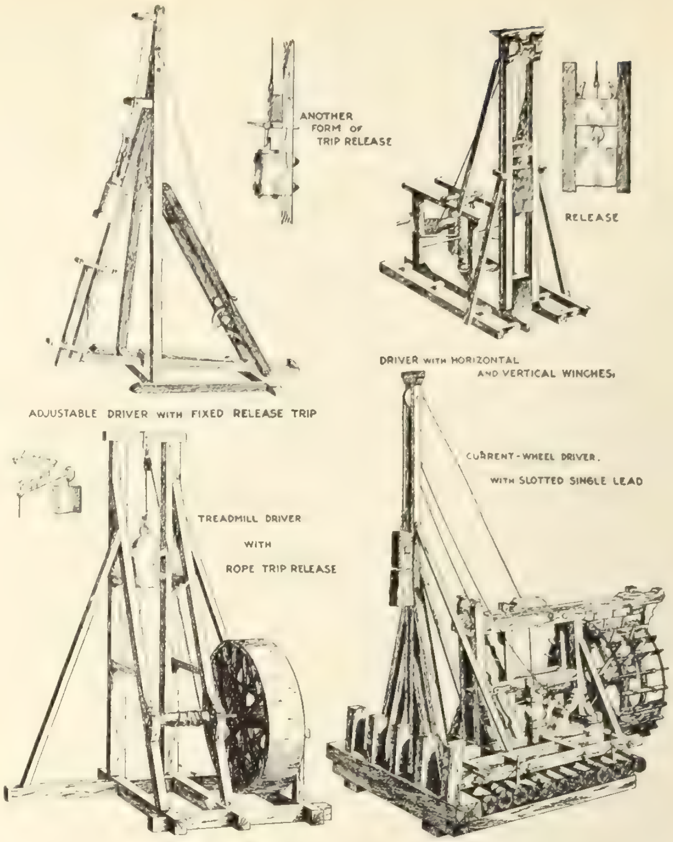

ANOTHER FORM OF TRIP RELEASE
RELEASE
ADJUSTABLE DRIVER WITH FIXED RELEASE TRIP
DRIVER WITH HORIZONTAL AND VERTICAL WINCHES
CURRENT-WHEEL DRIVER. WITH SLOTTED SINGLE LEAD
TREADMILL DRIVER WITH ROPE TRIP RELEASE

Fig. 2.—Four mediaeval winch and trip arrangements.

The application of the winch to piledrivers is shown in various forms in Fig. 2, also sketched from models in the museum. An essential requisite in such machines is a ram trip. Various forms of releasing hook are shown, tripped by hand or by fixed (probably in some cases movable) dogs. The nature of the releasing devices is clearly enough shown by the sketches to require no special reference. It is worth remarking, however, that the scow driver shown at the right at the bottom probably had a clutched winch-drum, instead of a releasing hook. There are cases in which both devices were used, the releasing drum then being probably a time-saving device in returning the rope to pick up the ram after a blow.

We have to thank Dr. Oskar von Miller, Munich, Germany, founder and president of the Museum, for photographs of the models and for the opportunity to make sketches in the museum.

These old-time piledrivers make it specially interesting to find, in inspecting German construction work, that steam-hammer piledrivers there are generally worked with manual operation of the steam valve.

In different jobs carried out by first-class contracting firms, in both land and scow driving, one man was constantly occupied at the valve rope, giving it a pull for every blow. On inquiry it was explained that this style of steam-hammer driver was used because automatics are not yet in a satisfactory perfected state.

With further reference to the above historical sketches, a note on American piledriver construction of 1841 may be of interest. It indicates that power piledrivers were exported to Europe from America even

70 years ago. The item was reprinted by the American Railroad Journal from the Oneida (N.Y.) Whig of the same year, and reads as follows:

> Steam Piledriver.—Messrs. Pond, Higham & Co., the enterprising proprietors of the Vulcan Iron Works in this city, have just completed a machine for driving piles, which is to be sent out to Liverpool, England, from whence it was ordered by a company who have taken large contracts on the great Russian railroad. This machine, which we saw in operation on Tuesday last, is worked by steam, and with half a dozen hands to manage it, is capable of performing the labor of 200 men and 20 old-fashioned piledrivers It carries its own locomotive, sets up the piles, drives them, and cuts them off at a proper grade with a circular saw.

The Construction of Gravity Concrete Chimneys

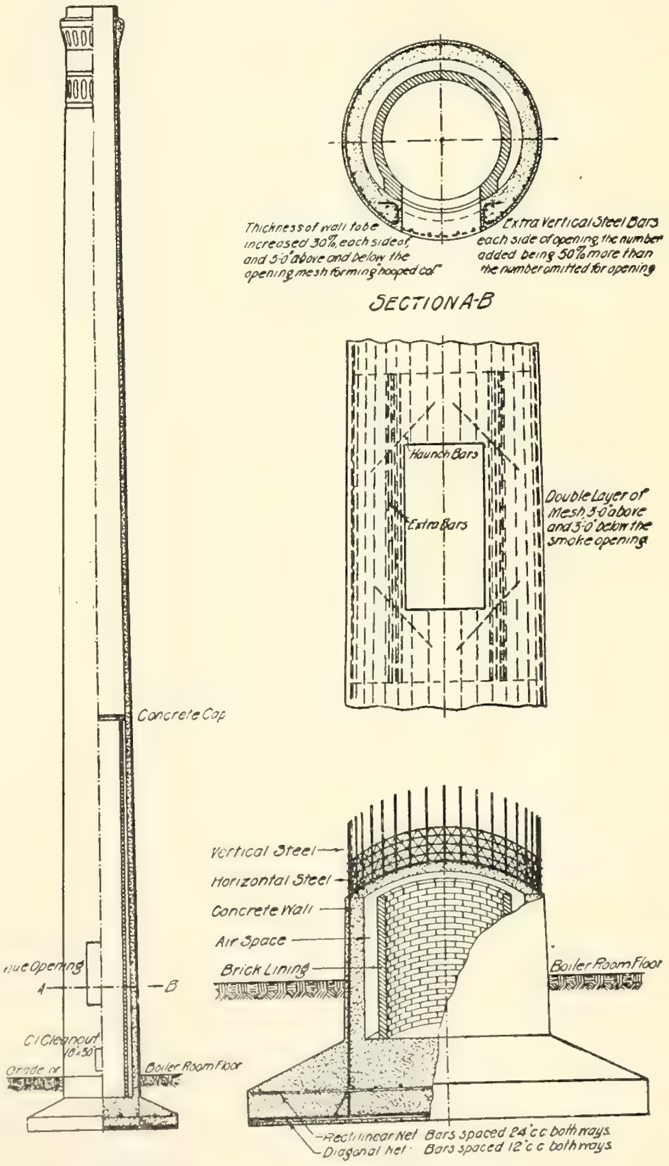
By R. S. Draper*

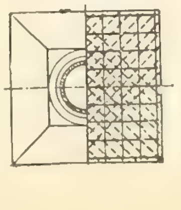
REINFORCED concrete chimneys have been so widely employed in the past ten years and the subject has been so ably covered in engineering literature, that but little remains to be said, beyond calling attention to their increasing popularity and proven permanence. However, a new type has several times been employed on important works, and while considerably more costly than the generally accepted design, has been given preference by a few consulting engineers, owing to the fact that its particular features practically eliminate danger from the personal equation in the builders, and also greatly increase the safety factors.

We refer to the "gravity" chimney, so-called by reason of its stability at all points being dependent upon weight alone, the prime requisite of the design being that the moment of stability at any or all sections exceed the wind moment. There would thus be no resultant positive bending moment, hence no tensional strain to be absorbed by the vertical reinforcement, other than that resulting from temperature changes without and within the structure.

The first "gravity" chimney of reinforced concrete was built for the Muncie Electric Company, at Muncie, Ind., 258 ft. in height over all, with a minimum inside diameter of 14 ft. 6 in. inside the lining. The shaft has a uniform taper, and is 25 ft. 3 in. in diameter at the base outside, and diminishes at the rate of 2 in. in 5 ft. to an outside diameter of 16 ft. 10 in. at the top. The inside diameter diminishes at the rate of 1½ in. in 5 ft. from 21 ft. 9¾ in. at the base to 15 ft. 6 in. at the top. The wall thickness diminishes at the rate of ¼ in. every 5 ft., from 20⅝ in. at the base to 8 in. at the top. This chimney had a nominal inside diameter of 14 ft. 6 in. and the inside diameter of the concrete wall at the top provided 1 ft. more than this, which made provision for an independent lining of fire brick, extending the entire height of the chimney. The fire brick usually used are 4½ in. in width, which leaves an air space of 1½ in. on the inside of the concrete wall at the top. The lining on the Muncie chimney was carried plumb its entire height, and was divided into three equal divisions of about 85 ft. each, of 13 in., 9 in. and 4½ in. wall. The 4½ in. wall and the inner 4½ in. of the 9 in. and 13 in. wall consisted of fire brick, and the backing consisted of a hard burned red brick of a less refractory clay. The lining was further supported by six pilasters, equally spaced, bonded into the fire brick lining, and extending into the insulating air space, but clearing the inside of the concrete wall by 1-in., permitting free and independent expansion of lining.

Two diametrically opposite openings 13 ft. high and 8 ft. wide were left for breeching connection, the stack being located midway between two batteries of boilers. A baffle plate of reinforced concrete extends diagonally across the line of breechings, and extends 10 ft. stack at an angle of 60 deg. from the centre above the top and 10 ft. below the bottom of the openings, being keyed into the lining. The concrete wall is made considerably thicker on all sides of the flue openings, the additional width of wall extending into the air space inside, and this compensates for the compressive area of concrete cut out for the openings. At the sides of fthe openings, additional vertical steel is provided to carry the temperature stresses from above and below the openings, past that point. Diagonal bars are provided at all corners of the openings to prevent cracking at those points, and to serve the purpose of forming approximate arches of the reinforcement. The stresses


Thickness of wall to be increased 30%, each side of, and 5'-0" above and below the opening mesh forming "hooped col"
Extra Vertical Steel Bars each side of opening, the number added being 50% more than the number omitted for opening
SECTION A-B
Haunch Bars
Extra Bars
Double Layer of Mesh 5'-0" above and 5'-0" below the smoke opening
Concrete Cap
Flue Opening
A
B
C/Cleanout 18"x30"
Grade or
Boiler Room Floor
Vertical Steel
Horizontal Steel
Concrete Wall
Air Space
Brick Lining
Boiler Room Floor
Rectilinear Net Bars spaced 24" c c both ways
Diagonal Net Bars spaced 12" c c both ways



Details of typical reinforced concrete tapering chimney.

The Construction of Gravity Concrete Chimneys.

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* Contracting Engineer, General Concrete Construction Company, Chicago, in Concrete-Cement Age. This company designs and builds tapering concrete chimneys of the type described.

used are conservative, 16,000 lbs. for steel in tension and 350 lbs. for concrete in compression.

The mesh reinforcement used encircles the vertical reinforcement from bottom to top of shaft, and is tied to it at intervals. The vertical reinforcement consists of square twisted bars varying in number, diminishing as the top is approached, but in no case more than 18 in. apart. These serve for reinforcing against temperature stresses only, as the chimney is of true gravity design and there is in no place a bending moment resulting from wind pressure.

Application of Battering Lines and Plumb Rules*

ORDINARY tools in building and engineering work are always within the scope of mechanical application, although extraordinary or unusual tools are not. Therefore, in this article it will be my purpose to treat of one of the latter class—that of the battering rule. Take, for example, a chimney or smoke stack to be built, say 50 ft. in height, either round or square, in cross section and diminishing or battering from 8 ft. in width or diameter at the base to 4 ft. at the top. The question naturally arises how will it be possible to build this stack so as to work out exactly to the dimensions given. The answer is by the use of the battering plumb rule shown to the left at the base of the brick smoke stack or chimney illustrated in Fig. 1. Assuming that many mechanics are not familiar with the method of making this tool we offer the following suggestions:

Primarily the battering plumb rule might in practical work be compared to a simple arithmetical problem in proportion, thus: The chimney stack is 50 ft. high and diminishes or tapers on one side 2 ft. If the side of 50 ft. decreases 2 ft. in that distance, how much will it decrease in 4 ft., which we will assume to be the working length of the rule to be convenient for handling.

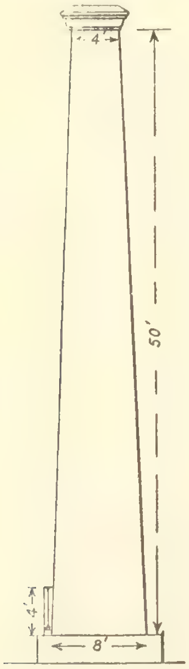


Fig. 1.—Use of battering plumb rule at base of brick smoke stack or chimney.

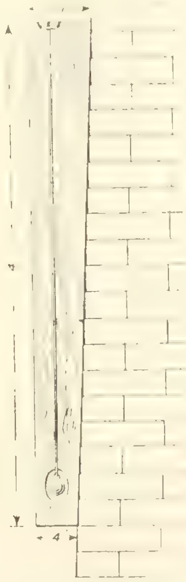


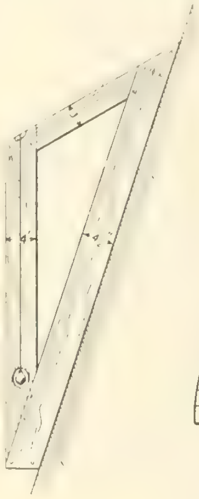
Fig. 2.—Battered plumb rule applied to brick-work of stack.

Reducing 4 ft. to inches gives 48, which multiplied by 24 in., the amount the chimney decreases in diameter, and divided by 600, the height in inches of the chimney, gives 1.92 in. batter for the 4-ft. length of rule.

To find the plumb rule batter for 100 ft. in height, divide 1.92 by 2, which gives .96 of an inch.

Continuing this operation for heights of 150, 200, 250 and 300 ft. gives as results .64, .48, .384 and .32 in. respectively.

Assuming that these simple calculations will be readily understood lesser subdivisions can be taken either by decimals or fractions as represented in Fig. 2 of the sketches.



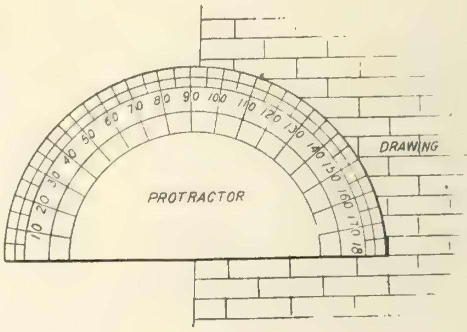


Fig. 3, on the right—Determining the angle or degree of batter by the protractor. On the left, Fig. 4—Framed plumb rule for a battered wall.

Another practical way of ascertaining the amount of batter is that shown in Fig. 3, which for simplicity cannot probably be excelled. The method is to take a horn or brass protractor, usually found in a set of drawing instruments, and place it on the plans, keeping the diameter line on any horizontal joint of the elevation. Then by multiplying the radius of the semicircle by the length of the plumb rule the full decrease in taper will be found.

Suppose, for example, the stack diminishes 1 deg. and that the radius of the protractor is 2 in., it will diminish 24 times 2 in. in 4 ft., or 48 in. Again, a steel square graduated to 64ths or 32nds will serve the same purpose, always maintaining extreme accuracy at the measurement points. It is best, however, to have the architect or engineer verify the slope or batter as he designs the stack. Coming now to the actual making of these rules as tools, it will be observed in Fig. 2 that there is very little difference in the tool here represented and the ordinary plumb rule with the exception that it is wider at the top than at the bottom, this being so in order to obtain the proportion of batter.

Here we might introduce the matter of curved vertical structures. For example, such a rule as that described may require to be slightly hollow on its working edge so as to form a slight entasis or curvature of the constructed mass of brickwork, concrete or whatever the material, so this hollowness must be very accurately followed in doing the actual work.

When the batter is excessive—approximately 60 deg. or more—a good practice is to build up each rule in the manner represented in Fig. 4 of 3 or more pieces of white pine, properly halved and screwed together by the carpenter so as to be firm, stable and unalterable. At the left is shown the line and plumb bob made as in the usual tools; the pieces gauged and the tool absolutely accurate. This rule should not be too heavy and can be applied with both hands and must be always true and out of wind.

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* By Owen B. Maginnis in the Building Age.

Angles and intersections in this kind of work require much definite laying out and methodical measuring. Witness Fig. 5 where one batter and one curved wall of concrete join together at an angle of 45 deg., as represented by G H on the plan. The height of the wall A B is 22 ft., as shown by the section B A C. The slope or batter of one part is 2 ft. and the projection of the curve of the other is also 2 ft., being an arc of a circle, struck from a center not in the drawing. These proportions have been somewhat exaggerated in the engraving so as to better illustrate the method to be explained.

To gain the angle and curve of intersection between these two walls in the simplest manner, first divide the altitude A D into any number of equal parts as ten, and from the points of division drawn horizontal lines as 1-a, 2-b, 3-c, etc. From their intersections with the curve, a, b, c, etc., carry lines down through the plan indefinitely.

Construct also a section of the battered wall as shown by D F E, and divide its altitude D F into ten equal parts as before, carrying lines at right angles to D F to cut the straight line D E; and from these points of intersection carry lines parallel to D F into the plan to cut lines of corresponding letter dropped from the section B A C, as shown by the curved line from G to H, which will give the true plan of the miter. From each of the intersections in the plan erect lines at right angles to the straight line G H, making the line from G equal in height to A B or E D as shown by G J, and divide it also into ten equal spaces. From the points so obtained draw lines at right angles to G J to cut lines of corresponding number brought up from the intersections previously obtained on the plan as shown by a′, b′, c′, etc. Then the curved line H J so obtained will represent a section on the curved line G H of the plan, from which it will appear that the line H J deviates from a plane an amount equal to the deviation of the curve G H from the straight line G H.

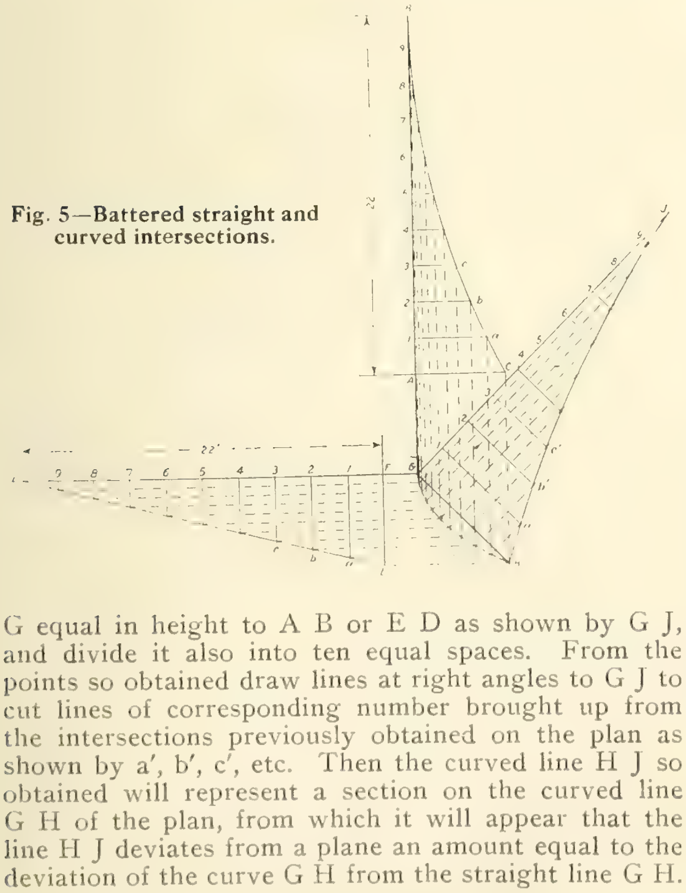
Fig. 5—Battered straight and curved intersections.

According to the United States Bureau of Standards, the melting points of fire brick are as follows: The most common fire brick, or those made of clay of which the main ingredient is kaolin, will melt at a temperature ranging from 2,831 to 3,137 degrees F.; bauxite brick, from 2,949 to 3,245 degrees, silica brick, from 3,092 to 3,101 degrees, chromite brick, at 3,722 degrees, and magnesia brick, at 4,929 degrees. These melting points, which represent the lowest temperature at which a small piece of the brick could be distinctly seen to flow, were determined in an electric vacuum furnace, the temperature being measured with an optical pyrometer.

Quality of the Material Used in Building Construction

A VERY vital matter in building construction concerns the grade and quality of materials to be employed and in one of the recent Monthly Letters of Secretary Sayward of the Master Builders' Association of Boston, he comments on the subject as follows:

"I believe that viewed through the eye of owner, architect, builder, materialman or the general public, this subject will be found to present the same aspect and thus prove that the use of the best materials is of the greatest benefit to all concerned.

First, from the standpoint of the owner it will be seen that the use of such materials leads to the highest satisfaction because best grade does what is required by the conditions perfectly and with a greater degree of permanency, thereby lessening depreciation expense. These two qualifications also make for increased rentals.

Second, from the architect's point of view best materials are productive of the best results for these reasons: (a) A first-class article reflects credit upon the architect, for it publishes his knowledge of the goods upon the market and his power to select the most suitable, whereas the use of an inferior grade may throw doubt upon the architect's discernment, whether such selection was made intentionally or not, for the general public will not stop to analyze; (b) from their greater durability, high-grade materials please the owner continuously. The architect will find his client as satisfied with his building at the end of a considerable period as he was at the end of the first few months; (c) working with first-class units the architect is able to combine them into a more effective whole from their physical adaptability and also from the greater moral incentive to good work which the use of the most suitable materials creates.

Third, as the builder and contractor view this question, the arguments in favor of the best materials are seen to be very similar to those influencing the architect. (a) Appreciation of the merits of first-class articles which have been incorporated in a building will be pretty sure to reflect credit upon the builder, although he did not specify their use; (b) a good workman is always stimulated to produce the best workmanship when the best materials are furnished; (c) good workmanship is also easier of physical accomplishment through the use of the most suitable materials; (d) deterioration of poor materials always renders the construction work liable to a verdict of bad workmanship, at least from those not specially informed.

Fourthly, we may view the question as a material dealer. Here we see that the use of an inferior article giving unsatisfactory results may reflect upon the dealer despite the fact that this inferior quality may be allowable under the specifications or due to the selection of the contractor. Presumably, also, there is more profit in handling a high-grade rather than a low-grade article.

Lastly, from the position of the general public the use of the best materials will prove most desirable because—(a) the use of an inferior product tends to demoralize the appreciation of first-class construction and consequently lowers standards; (b) buildings constructed of poor materials through the necessity for frequent and undue repairs, increase the cost of maintenance to the owner, and this is in some degree reflected on the general community.

Engineers and Contractors*

By F. W. Cable, Assoc. M. Inst. C.E., Assistant Surveyor, Westminster City Council.

THE question of the relations between the engineer and the contractor is one which has attracted a good deal of attention in late years, but no legal decisions or other outside issues will eliminate their differences, unless both are actuated by a desire to treat their differences on a broad basis, having regard to the welfare of their clients.

Individual engineers adopt different attitudes towards the contractor in the carrying out of works. There is the engineer who is very sympathetic towards the contractor, and is too ready to grant "extras," the effect being that the list of extras automatically grows out of all proportion to the job, and then the other extreme is the engineer who considers it his duty to extract the full pound of flesh out of the contractor by any means legally within his power. Both these attitudes are financially unsound from the point of view of the clients for whom the engineer is acting.

In the first case, without imputing any bad faith on the part of either the engineer or contractor, unnecessary work and materials are put into the scheme involving expenditure for which no equivalent benefit is received, while in the latter case it is unfortunately only too true that the engineer forgets that he is the legal arbitrator between the council and the contractor. It is his place to interpret the specification in such a manner as to ensure the work tendered for being carried out by the contractor in an efficient and economical manner; but it is not his duty to use any clause in the specifications to compel the contractor to do work which was not and could not have been contemplated when the tender was sent in.

It is absolutely essential that public works should be carried out as far as possible as a business undertaking and not as a speculation.

As an example of what I mean, let me suppose a contractor tenders for a scheme of sewerage, and, as is often the case, there is no anticipation of rock being met with, trial holes not even eliciting the fact. Soon after the work is commenced the contractor finds himself confronted with various sections where blasting operations have to be undertaken, and every yard of pipe laid entails a considerable loss. Now, the contractor must do one of two things, either make provision when tendering to cover the risk, or else he is speculating on the work, and, being human, must get what he can out of the remainder of the work. If he makes provision in his tender it is perfectly obvious that in the event of no rock being met with the council are losing financially to the extent of the provision thus made.

In brief, the council want certain work done, and they should pay a fair price for the work being carried out. If natural and unavoidable difficulties are met with, they are a legitimate charge to the cost of the scheme, and should be borne by the council and not by the contractor.

It was quite recently told by a well-known firm of engineers of a case where sewerage works were contemplated, and several holes were taken out for the benefit of the contractors tendering. On one side of the town a trial hole was taken out, and it was found to be solid rock. Now the contractors all tendered on the assumption that rock would be met with in this district, whereas when the work was done it was found that by mere chance the spot selected for the trial holes was on a solitary boulder of rock, and in no other spot was rock found. It will be readily seen that the ratepayers lost heavily on this occasion, quite unnecessarily.

The International Building Exposition, held in Leipzig, Germany, during the past summer, has announced its awards, and these include three American engineering organizations and an American engineer. The Alsace-Lorraine prize was awarded the Board of Water Supply of New York. The gold medal of the city of Leipzig was awarded to Gustav Lindenthal, the American Bridge Company, and the Strauss Bascule Bridge Company. Mr. Lindenthal, in connection with the American Bridge Company, exhibited plans of the Hell Gate Bridge, etc., while the Strauss Company exhibited models and photographs of its bascule and lift bridges.

Artificial marble made with white Portland cement as a base has been developed by the Art Stone Company, of Waynesboro, Penn., and very beautiful samples of the material were shown by the inventor of the process at the recent American Road Congress in Philadelphia. The process is applicable for making artificial ornamental tiling for use in any place where colored marble tiling would be applied. It is claimed that as mineral colors are used, the surface is permanent and will not fade on exposure to the light. The coloring is used in the surface only, the body of the tile being made up of ordinary cement. In order to secure a smooth, polished surface on the material, the tile is cast with its face against a sheet of glass.

The addition of finely ground blast-furnace slag to an ordinary clay of moderate fatness is said to be a simple means of producing an excellent vitrified ware suitable for stoneware and paving brick and tile. The slag, being in the form of a ready-made frit, acts as a very energetic flux, and one which is not damaged by prolonged storage. The iron compounds and other coloring agents in the slag are not usually objectionable, as the color they produce is an agreeable gray. The slag must be ground very fine as the particles are somewhat sharp and may form unpleasant specks if insufficiently ground.

In discussing the construction of concrete buildings in a paper before the Boston Society of Civil Engineers, Leonard C. Wason, President of the Aberthaw Construction Company, Boston, advises casting the stairs considerably later than the floors and in a separate operation. In casting the floors, rods are left projecting from floor to bond in the stairs, thus preserving the same measure of strength in the latter as would be the case were the whole job done at once.

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* Extract from paper read at a meeting of the Institute of Sanitary Engineers.

Drilling as a Test for Concrete

THE investigation described in this article was undertaken in order to determine the relation between the compressive strength and speed of drilling of concrete when the personal element is eliminated. It was carried on as thesis work at the University of Wisconsin and was prompted by a controversy which arose over the quality of concrete in the Southwest Land and Lake Tunnel, Chicago. In order to determine the quality, holes were drilled by hand in the concrete lining. The writer disagreed with the conclusions and, therefore, undertook these tests. The record of a portion of the hand-drilling tests is shown in Fig. 2.

The compressive tests were performed in accordance with the rules at the testing laboratory of the University of Wisconsin. The specimens upon which the compression tests were made were cylinders about 6 in. indiameter and 18 in. long. These specimens were made from the same materials and in the same manner as in the case of the boring specimens. All specimens were broken in a 100,000-lb. Riehle testing machine.

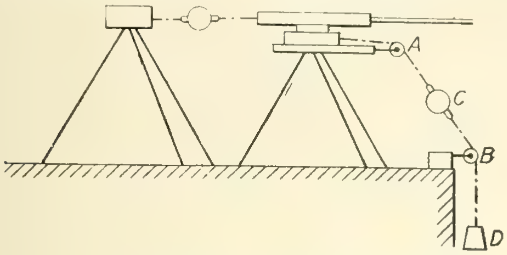


Fig. 1—Arrangement of constant feed pressure

Specifications for Drill Tests

Object.—The purpose of this experiment is to determine the speed of boring through concrete by mechanical means, when the personal element is eliminated. The ultimate object is to discover the relationship, if any, between the compressive strength of different kinds of concrete and the speed with which it can be bored. This line of experimentation is warranted, first, because of the fact that concrete tunnel linings are sometimes examined both as to the quality of the concrete and the depth of the lining by boring, and, second, because, as concrete is frequently used both in temporary and permanent building construction, it becomes necessary at times to wreck such structures, and in so doing boring is resorted to.

Apparatus.—In making complete tests two sets of apparatus shall be used. The first set is to be used in the compression tests and the second in the boring tests. The compression tests are to be performed in accordance with the standard specifications in use at the mechanical laboratory of the University of Wisconsin, and will not be discussed here. The boring tests will be made with the use of the Fort Wayne Electric Company's rock drill, type A, from which the ordinary hand feed is removed and an automatic feed with a weight substituted. There shall be suitable apparatus or means for maintaining the specimen in a rigidly fixed position with respect to the drill. Drill steels shall be of 1 7-16-in. diameter and sharp, as are usually employed in ordinary drill practice. No water shall be poured into drill hole to accelerate the boring speed.

Method of Test.—The drill shall be set up firmly, and thoroughly inspected to insure its good and efficient working order before any specimens are tested. The feed pressure in all the tests shall be about 70 lb. During the boring each drill shall be inspected from time to time, and it shall be replaced by a sharper one when it begins to grow dull. The boring shall proceed through periods of time as conditions shall dictate, and at approximately 860 r.p.m.

Data.—The data required will be the depth of each hole, the time, the total number of revolutions, the materials of which the concrete is made, their proportion, as well as the unit stress in compression for each specimen.

General.—In standardizing the methods of boring in these experiments conditions as near as those met with in actual rock drill work as possible are sought after, so that the result may be applicable to the ordinary cases of rock or concrete drilling as conducted at the present time.

Test Pieces

There were two kinds of specimens used. The first had been used in permeability tests made at the university. They had the general shape of a truncated cone, 20 in. in diameter at the base and 18 in. at the top. The height was 9 in. For the purpose of conducting the permeability tests, bottomless cast-iron jars, 16 in. in diameter, had been embedded in the concrete.

The other specimens were also in the shape of truncated cones with 20 and 18-in. diameter end areas. There were three of these, two 8 in. and one 6 in. high. The stone used was Niagara limestone taken from the marine section of the Southwest Land and Lake Tunnel in Chicago.

Drill and Motor

An electric rock drill manufactured by the Fort Wayne Company, of Madison, Wis., was used. It is known as type A, form 1, size 10, serial number 154. The motor for driving the drill was a d.c., 115-volt, 21-amp., 4-pole, compound-wound, 25-h.p. machine of 2200 r.p.m. It is known as type D, form C, serial number 32,455. The feed screw was removed from the drill so that it could slide freely in the guides, which were oiled so as to reduce the friction as much as possible.

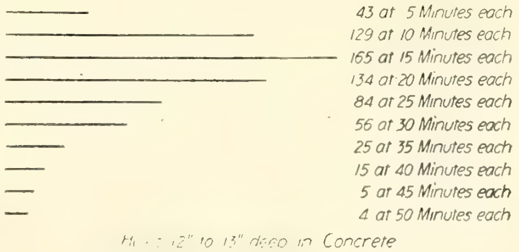


Fig. 2—Record of hand-drilled holes.

The feed pressure was supplied by a system of pulleys and weights. The drill was mounted on an extra-heavy tripod. The points of the legs of the tripod were fixed in small depressions made in the concrete floor. A chain was passed over the upper part and fastened by a turnbuckle to an anchor concreted into the floor. Before fastening the tripod its upper surface was put in a horizontal plane by the use of a spirit level.

The specimen was held firmly in the jaws of a large hydraulic testing machine. In order to secure a firm bedding, 6-in. timbers were hollowed out to the curvature of the specimen, and with other blocking placed in between the jaws of the machine and the specimen.

In order to determine the net feed pressure transmitted to the specimen, another tripod (Fig. 1) was set 4½ ft. to the rear of the machine and in line with it and the specimen. Another spring balance was fastened between the drill and the second tripod by a thin wire rope.* This rope was placed as near as possible in the same horizontal line as that described by the centre of gravity of the drill as it moved in its guides. The machine was put in operation, and after a number of trials the two spring balances were found to read practically the same.

Normally, the drill makes 860 r.p.m. This was tested and it was found that the speed was not quite constant. It was therefore decided to take the total number of revoluions for the drilling of each hole. The time was taken by a stop watch and the revolutions from the shaft of the revolving helves. The drill was struck two blows, one by each hammer for each revolution.

Before beginning the drilling of each hole a slight depression was made so that, when starting, the drill would be held in one place. Preparatory to drilling the machine was moved back until the steel was about 4 in. from the concrete. The drill was then started revolving and allowed to aproach the concrete at a moderate speed. When the drill touched the concrete an assistant gave the signal, and from that instant time and revolutions were recorded. Two marks had been placed on the ways of the machine, giving the depth of the hole to be drilled. When the second mark was reached the signal was given and the counting stopped.

Weights amounting to 70 lb. were used in all but two instances. For the 70-lb. weight the net feed pressure transmitted was 68 lb. The no-load current was 2.5 amp. and the full-load varied from 14 to 16 amp.

Conclusions

As a result of the tests the following conclusions were reached:

1. The experiments were not extended enough to make it clear whether there is any definite law existing between the boring speed and compressive strength of all grades of concrete.
2. The supply of electrical power to the motor was at times not constant, and there were also occasional slight vibrations of the specimen.
3. There was undoubtedly some difference in the sharpness of even new drills.
4. Each drill grew duller as the boring progressed. The rate at which different drills grew duller varied.
5. Despite these facts, however, it would appear that, all things being equal, the rate of boring concrete would, in a general way, vary inversely as the compressive strength.

In view of the wide variation in results it is believed that the conclusion drawn from Fig. 2 are somewhat misleading. The report in which these conclusions were drawn states: "After the drillers had completed the holes in Drift 20 they had become quite expert and their work was fairly uniform, so that it was possible to form a pretty good idea of the character of the concrete from the time it took to drill the holes to a depth of 12 inches, and the men were average drillers." That the drilling furnished a very unreliable criterion as to the character of the concrete is evident for the following reasons: (1) The variation in the age of the concrete, it being from two and one-half years to six weeks old; (2) the personal equation of the drillers; (3) the condition of the drill as to sharpness or dullness; (4) the failure to differentiate between these factors.—Engineering Record.

Sand Foundations for Tall Buildings

It is a well-known fact that sand can sustain very heavy loads with comparatively little or no compression and when it directly overlays rock or other thick, hard stratum that is securely confined or otherwise protected against the possibility of lateral displacement it forms a very satisfactory foundation and will carry with safety heavy loads as long as these conditions are maintained. It is for this and other reasons that many heavy buildings of moderate height have foundations resting on the sand, usually only a few feet below the surface. Almost all of them are at or above ground water level. Heretofore they were made with timber and masonry footings, then of concrete, and now almost entirely of reinforced concrete or steel beams enclosed in concrete.

It is the general practice to support the columns of a building singly or in small groups on isolated separate footings proportioned to reduce the loads to substantially the same unit pressure on all.

When the 15-storey Spreckles Building was erected in the city of San Francisco some fifteen years ago it was built with all of its columns seated on a double grillage of continuous I-beams reaching entirely across the site in both directions and embedded in a mass of concrete more than 4½ feet thick resting on wet sand 25 feet below the surface of the street. In the case of the 26-storey St. Paul Building at Broadway and Ann street, in New York City, the columns have steel beam and girder grillage with concrete footings on the wet sand about 30 feet below the street. The Engineering Record states that the sand was loaded to 8,000 pounds per square foot and in several years has settled only a fraction of an inch and with such regularity that it has been unnecessary to adopt the special provisions designed for compensating irregular or excessive settlement.

In the new Municipal Building spanning Chambers street on Centre in New York City, a part of the foundations is carried to solid rock and part is supported on wet sand nearly 90 feet below the surface. As this building is 25 storeys high and has a 15-storey central tower rising to a height of 580 feet above the street, the pressure on the sand is 12,000 pounds per square foot.

The foundations of the 32-storey building in the city of Cincinnati consists of steel grillages enclosed in concrete and imposing a load of 11,000 pounds per square foot on dry sand about 500 feet below the street. In this case the foundations carry an estimated total load of about 104,000,000 pounds and occupy about 70 per cent. of the entire area of the building.

A trench 4 ft. wide and 7.5 ft. deep has been cut through the solid masonry and flint-rock concrete of the Pont Neuf, Paris, bridge structure with the aid of helicoidal wires and abrasive powder. The section trenched in this way, 550 ft. in length, was found to be too hard to be attacked by tools, while explosives were excluded for fear of weakening the venerable arches. Four wire cuts were made in each of the three sections, each roughly 200 ft. in length. An 18 h.p. electric motor operated the continuous-belt cutting wires, which were held taut by weights, while abrasive powder was fed into the cut.

Improved Brick-Making at Ormstown, Que.

IN common with other Canadian cities, Montreal is using more and more brick each year, one reason being that several municipalities have passed by-laws prohibiting the construction of lumber houses, and another that the building programme has naturally expanded. Architects are also alive to the possibilities of brick as a building material, and both for residences and offices it is being employed freely with artistic effect. This year a considerable amount of capital has been spent in establishing new plants and improving old ones in the Montreal district.

The Ormstown Brick Company, Limited, is one of the plants which has been extended with a view to meeting the growing demand. It is situated about 47 miles from Montreal, on the Massena Springs branch of the Grand Trunk Railway. Brick from Ormstown has been shipped into Montreal on a small scale for the past thirty years, and is favourably known for its hardness and rich red color. The company's clay beds of about 40 acres contain what is stated to be a good brick clay which will compare favourably with almost any common brick made from surface clays in Canada. Tests made by the University of Toronto from samples of clay, consisting of two feet of sandy loam, 7 feet of rather fat brown clay, and a small quantity of blue clay which underlies the brown clay, show that they work up into a mass of good plasticity with 24 per cent. of water and work easily. The drying shrinkage is 6.5 per cent. The clay gave the following results on burning:

Cone	Fire Shrinkage	Absorption
07(1850F.)	0 p.c.	15.8 p.c.
05(1922F.)	1.0 p.c.	13.5 p.c.
03(1994F.)	3.0 p.c.	8.0 p.c.

The clay burns to a good red body, almost steel hard at cone 0.7. The fire shrinkage is low and the absorption not excessive. At cone 0.3 the body is steel hard, the absorption low and the color deep rich red. The clay makes a good quality of porous field drain tile when burned to 1900 F.

A chemical analysis of a mixture of two parts of the fat brown clay and part of the blue clay gave the following results: Silica, 62.17 per cent.; ferrous oxide, 4 per cent.; calcium oxide 4.14 per cent.; aluminium oxide, 19.34 per cent. magnesium oxide, 2.80 per cent.; sulphur trioxide, .18 per cent.; loss on ignition 4.35 per cent.—a total of 96.98 per cent., the undetermined 3.02 per cent. being probably a mixture of the alkalies, sodium, and potassium and carbon dioxide. It is also stated in the report that the clay with a small admixture of sand is capable of a fast dry temperature.

Three plants are installed at Ormstown, with the following capacities during a ten-hour day—common brick, 45,000; pressed brick, 15,000; and common brick, 15,000. In addition, there is machinery for the manufacture of drain tile and terra cotta ware. The company have a Martin Pipe Rack stem dryer, which utilizes the exhaust from the engine—an economical method of drying. There are four down draft Eudaly kilns having a capacity of 130,000 each, and five Case kilns with a capacity of 300,000 each. Coal is used entirely for burning purposes, as the price of wood in the locality has advanced to a prohibitive price. Besides the pipe rack dryer, the outside drying rack and pallet system is used, the capacity being 160,000. The brick is conveyed from the machines to the dryer and from the dryers to the kiln by means of cables, thus doing away with expensive labour.

The company are now making arrangements to build a large tunnel dryer so that the output for the coming season may be trebled and that they may be in a position to take care of all orders offered them. Owing to the limited output during the last summer, orders had to be declined.

A Grand Trunk Railway siding, 1200 feet long, runs on to the property, enabling the products to be economically shipped to Montreal and border towns in the State of New York, where a considerable trade has been done, owing to a reduction in the American tariff.

An increase in the exports of manufacturers will be the leading feature in the export record of the United States in 1913. According to the Department of Commerce, the export of railway cars will show a total approximately double that of last year, the figures for the nine months ending with September being $30,500,000. Automobiles and parts, including engines and tires, show a total export value of $30,000,000 in the first nine months of this year, as against $25,000,000 for the same period of 1912. Metal-working machinery shows an increase of $1,500,000 for the same period; pipes and fittings, an increase of $3.500,000; copper manufactures, an increase of $12,750,000; while refined mineral oils for the same period show a total exportation of $102.000,000, against $88,000,000 in the same months of 1912.

"Districting" cities is a not uncommon practice in Europe, especially in Germany, but the first American city to adopt the plan is Minneapolis, Minn. A law enacted by the Legislature of Minnesota, at its last session, permits cities with a population exceeding 50,000 to establish exclusion districts. When petitioned by 50 per cent. of the property owners in a neighborhood, a City Council may, by a two-thirds vote, designate such neighborhood as a residential or an industrial district.

New Building Record for Port Arthur

Constructional Activity and Industrial Progress the Features of the Year Now Closing — Many Noteworthy Undertakings

By H. S. H. Goodier

ON the last day of the old year, the date of this publication, the city of Port Arthur can look back upon a year of unprecedented activity in constructional operations. Doubtless the records of the year will be surpassed in the years to come, but nevertheless it is to 1913 that we shall turn back as the date which marks the dawn of better days for the lake port—the year which ushered in an era of prosperity for Port Arthur and witnessed the introduction of metropolitan standards and metropolitan achievements.

Port Arthur's first building to approach skyscraper dimensions—the Whalen building. Estimated cost $500,000. Contractors, Canadian Stewart Company.

With the rapid growth of industrial life at the head of the Great Lakes, Port Arthur has been brought face to face with a number of fair-sized problems, not the least of which has been the housing of many hundreds of workmen. For many years this problem appeared to be almost insurmountable, but its solution is now being worked out by more than one company, among which may be mentioned The Canadian Resources Development Company, who commenced their house-building campaign as recently as June 20 last. In the first place this company planned to erect six five-roomed cottages as an experiment, but the structures were hardly completed when the erection of fifty more was authorized by the head office in Liverpool, Eng. These houses were erected at the record rate of nearly two a day. They are comfortable and compact, plastered inside, and wired for electric light. The accommodation comprises verandah, dining-room, two bedrooms, bathroom and storeroom. There are now approximately seventy buildings on the property.

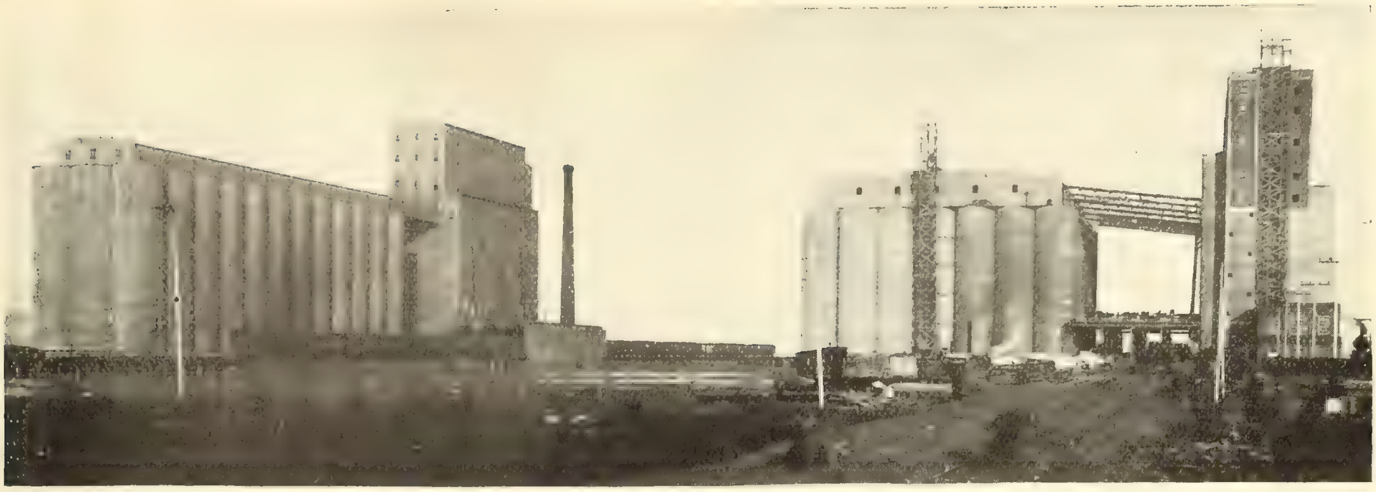
At the corner of May street and Central avenue a site of seventy-five acres has been laid out for athletic grounds on which comfortable buildings have been erected for the Port Arthur Winter Sports Club.

Quite a small colony of wooden residences has sprung up at Ray Park and even more enterprising plans are to be undertaken next season.

There has been marked activity in the north end of the city during the last few months, notably at Gresley Park, a sub-division occupying an excellent situation overlooking Thunder Bay and Lake Superior and connected with Port Arthur by the street railway. The leading constructional firms look forward confidently to establishing new records in 1914. The optimistic forecasts are based in part upon a report that a considerable amount of English capital has been enlisted on behalf of several important development schemes. One firm is said to contemplate the erection of not less than seven hundred houses and one hundred stores in the sub-division extending north from Gresley Park.

On the lake front at the south end of Port Arthur there has been built at a cost of $1,100,000 the first

Prospect Avenue School, Port Arthur, erected at a cost of $100,000.



On the right the new government elevator at Port Arthur erected at a cost of $1,100,000; capacity 3,250,000 bushels. On the left Thunder Bay elevator; capacity 1,750,000 bushels.

terminal government elevator in Canada. This elevator has a capacity of 3,250,000 bushels. We reproduce herewith a photograph of this structure. To the left of the picture may be seen the Thunder Bay elevator which has a capacity of 1,750,000 bushels. These two new plants play no small part in the grain storage capacity at Port Arthur which is now over 16,000,000 bushels. On the near right of the government elevator is the Davidson-Smith elevator and flour mills which are now in course of construction. The elevator will have a capacity of 750,000 bushels and the flour mills an ultimate capacity of 2,500 barrels.

One of the views reproduced herewith shows the eight-storey Whalen building, a handsome building faced with white terra cotta, erected by Mr. Jas. Whalen and associates at a cost of some $500,000. The contractors are the Canadian Stewart Company.

In the centre of the city is the new Government Armoury, the home of the 96th, Lake Superior Regiment, which is being built by the Dominion Government at a cost of $200,000. This building is of handsome red pressed brick and stone. The difficulties of the basement work can be understood when the nature of the surrounding ground is considered.

The largest industry at the head of the lakes, employing one thousand men all the year round, is the plant of the Western Dry Dock and Shipbuilding Company, Port Arthur, Out of these yards has been turned the flagship of the Northern Navigation Company, the steamer Noronic, the largest passenger boat on the Great Lakes. This boat, which is 385 feet long, was launched on June 2, after being completely built at Port Arthur at a cost of $750,000. There is now building at the plant of the Western Dry Dock and Shipbuilding Company the largest bulk freighter in the world, the vessel having a total length of 625 feet.

St. Paul's new Presbyterian church, Port Arthur. A well-designed building estimated to cost $100,000, exclusive of furnishings.

The fine weather of the fall and winter has been greatly in favor of outdoor work of all kinds, and as a result a great deal of late building is being carried on, especially in the residential sections. Houses started a few weeks ago, when the contractors had little hopes of doing more than the basement work until next spring, are now well under way. The excavation work for the large theatre on Arthur street is now completed and the concrete work for the basement is finished and the forms removed. The contract is let for the superstructure for $50,000 to Messrs. Seaman & Penniman, of Port Arthur, and this is to be proceeded with at once. The exterior of the handsome new Molsons Bank building is almost completed.

With all this building finished or in such good progress, 1913, with its millions of dollars of expenditure, appears to have set a record that will be hard to beat. And yet indications are that 1914 will eclipse 1913! Cathedrals for both the Anglican and Roman Catholic communities and a handsome new building for the Bank of Montreal are among the larger building prospects for the coming year. The Contracts Department of the Contract Record will have a serial tale about Port Arthur which should make interesting reading.

The B.C. Movement of the Canadian Society

NOTEWORTHY among the news articles contained in this issue is a report on the next page relating to the British Columbia members of the Canadian Society of Civil Engineers. As is well known to those who have followed the proceedings of the society in the columns of this journal, the engineering profession in British Columbia has been clamouring for provincial organization for a very long time. Now a resolution has been passed and it would appear that the parent society would have to accede to the request of the far western section of its membership. The matter was brought up very enthusiastically at the last general convention of the society in Montreal, and a great deal of correspondence bearing upon the question was received and published by this journal subsequently, so that it is unnecessary to go into a lengthy review of the pros and cons; suffice it to say, for the information of those who may be newcomers in the field, or who may have overlooked this development, that the present movement is being undertaken by the Vancouver and Victoria Branches of the Canadian Society of Civil Engineers, with a view to establishing a provincial division for the purpose of looking after purely provincial interests and legislation in British Columbia, which is so remote from the headquarters of the society in Montreal. The facts are set forth very clearly by the Engineering Record in an interesting editorial, from which we extract below. We are pleased to note that the editorial comments of our contemporary are thoroughly in accord with the stand taken by this journal from the outset.

"Both the American and the Canadian societies of civil engineers have established branches in many of the leading cities, which serve an excellent purpose of bringing together local members of the parent society. But they are limited in their activities chiefly to the reading and discussion of papers, and never represent more than the members resident in or near a single city. Never have municipal and government problems been of such importance to the engineer as at present, and any means whereby his influence can be strengthened deserves careful consideration.

"A move toward better territorial organization, the outcome of which will be watched with interest on both sides of the international border, is the united action of the two British Columbia branches of the Canadian Society of Civil Engineers in asking for the formation of a provincial "division," whose primary object would be the building up of a strong organization by increasing the membership and uniting the influence of the members within the province. It was at first requested that this division be given power to pass on the qualifications of applicants for membership and to veto elections of undersirable candidates, that it receive a rebate from all annual dues collected in the province, that it elect its own officers and be given power to discipline members of the society resident within the province. The council of the parent society decided that no special privileges could be accorded British Columbia, but that an amendment to the by-laws of the parent society would be in order which would make possible the organization of provincial divisions throughout the Dominion. It was decided, however, that these divisions could not be allowed the power of disciplining members or vetoing applications. After some correspondence, two amendments were drawn up, one by the parent society and one by the British Columbia branches. These are now being submitted to the corporate membership for letter ballot, the results of which will be known January 19, 1914.

"The British Columbia members have shown a disposition to accede to the wishes of the parent council, but they feel that a division formed on the basis of the by-law prepared by the council will be practically useless. Western members of the Canadian Society of Civil Engineers themselves say that in western Canada membership in the society carries little weight, and the general interest in the new movement by the British Columbia membership shows that the present status is not entirely satisfactory. The code of professional ethics recently debated by the Pacific Northwest Society of Engineers and the activities of the Oregon Society of Engineers prove that the interest of Western engineers in professional organizations is not limited to the passive functions of presenting papers at local meetings and reading reports on what has been done at Eastern headquarters.

"It is manifest that some sort of a division which will have a greater range of activity than the present branch would increase the influence of the parent society at the same time that it would afford the individual members a much-needed opportunity to have a voice in affairs of general interest to the profession. While the parent society does well to reserve certain powers which properly belong to the controlling body of the national organization, it might be well, nevertheless, to permit the formation of divisions with a sufficient range of power to make them effective in representing local interests. The division, under a good and sufficient plan of control, would be better for the individual than an independent organization, but if no encouragement or support is given in the formation of such divisions there will be a tendency to transfer activities to local organizations, in which the needs of the district and its professional men are better understood."

B. C. Engineers Active for Provincial Division

On December 13, at the closing session of the second annual convention of the British Columbia members of the Canadian Society of Civil Engineers, held in Vancouver, a resolution was passed in favor of establishing a British Columbia division within the jurisdiction of the parent society.

Resolutions were also passed in favor of giving wide publicity to all proceedings of the society, with published lists of practising engineering firms, and of approaching the management of the new British Columbia University with a view to representatives of the society being appointed to make suggestions in the way of the course of studies in reference to the engineering college.

Many addresses were delivered on interesting subjects and there was full discussion of the views presented, the consensus of opinion being that students should be given a stronger business training.

Education and Training

Mr. H. K. Dutcher, in speaking on "The Education and Training of Engineers" referred to the multiplicity of subjects which were taken. In regard to the training at colleges he offered the criticism that frequently there was too much crowded into the subjects, and that there was a tendency to emphasize some subjects to the detriment of others; the student had to be rushed through in such a way that he had not time to absorb the subjects in the way he should do. More results would be arrived at if more subjects were combined. He considered that it would be much better if lecturers had their addresses printed and circulated among the students, so that more time could be given up to discussions. He believed that to be successful, in the engineering college at the University care should be taken that the department should not go under the name of engineering, but under that of applied science, separate from other courses.

Knowledge of Business

In the discussion which followed, Mr. C. H. Stone, in pointing out conditions and offering suggestions, expected great things from the University, and had no doubt the expectations would be realized. Mr. W. A. Clement spoke in favor of stronger business training. Mr. Hayward said that only one out of ten who started out in engineering courses made a success. He considered it was a mistake to give too many subjects. What the student wanted was to get down to the beginning of things.

Mr. G. R. G. Conway, who presided, laid stress on the need for culture, and, therefore, thought classical education was a good thing. At the same time it was important that an engineer should be a business man.

Mr. Dutcher moved a resolution to the effect that the University be approached later on to appoint one or more representatives of the society as a committee to help guide the management in the way of the course of studies, which was unanimously carried.

An address followed on "The Professional Status of the Engineer in British Columbia." This was given by Mr. F. C. Gamble, Provincial Consulting Engineer.

THE ANNUAL BANQUET

At the annual banquet, held on December 13, Hon. W. R. Ross, Minister of Lands, spoke on the natural resources of British Columbia. He said that the production from the province's mining, lumbering, fishing, agricultural and manufacturing industries last year totalled in excess of a hundred and forty million dollars. In the five past decades the mining industry alone had produced over four hundred and thirty million dollars, and a year or two more like the last, which had produced over thirty-two million dollars, would place the output from mining at over the half-billion mark. He dealt with the vast forest areas, the tremendous water-power available and the province's coal area, the largest in America. The engineering fraternity, he said, bore an important relation to the development of these natural resources. Almost the entire success in many lines depended on the economics of engineering, and he felt that the men of that profession, realizing their responsibility, would rise to the occasion and do as well by British Columbia as nature had done by the province. There were many evidences in things they could all see around them that engineers were meeting conditions with the best in their power, wresting from the mountains and streams and forests the wealth that was theirs, and creating it into something of benefit to society. Mr. Ross dealt at some length with the work of the water branch of the lands department. It had been in operation for some years, but results were slow of attainment owing to the territory to be covered. But he said that they had shown that contiguous to Vancouver there was sufficient water to supply a city of seven million people, more than enough for the London of to-day. He hoped to live to see the time when Vancouver's population would be a million. Around Vancouver two companies had developed water-power and will be in a position to give 150,000 horse-power. Next summer they would have parties along the lines of the G. T. P., the C. N. P., the Kettle Valley and the P. G. E. railways investigating water powers in the districts which would be available for settlement with the completion of the new roads.

Others from Victoria included Messrs. W. J. Dart, F. C. Gamble, A. Horton and C. H. Rust.

Annual Meeting Victoria Branch C.S.C.E.

The annual meeting of the Victoria Branch of the Canadian Society of Civil Engineers was held on Thursday, December 11th, at the club rooms, 534 Broughton street, when the following officers were elected for 1914: Executive—Mr. F. C. Gamble, Chairman of Branch; Mr. D. O. Lewis, Vice-chairman; Mr. A. E. Foreman, Treasurer; Mr. R. W. Macintyre, Secretary, and Messrs. E. H. Harrison and Lewis W. Toms. Auditors—Messrs. H. A. Icke and F. A. Richardson.

The chairman gave a brief review of the work accomplished during the past year. While advocating a change of officers from year to year, he expressed his appreciation of being elected by acclamation to a third term in the chair.

Mr. J. B. Holdcroft read an interesting paper, illustrated with diagrams, on "Cellular Design of Vibrated Concrete Construction, with Especial Reference to Its Use in Sub-Aqueous Work," which evoked an animated discussion.

Sand-Lime Brick Men in Session at Harrisburg

Canadians Elected to Important Offices

THE tenth annual meeting of the Sand-Lime Brick Association was held at Harrisburg, Pa., December 9-10. The president, Mr. S. O. Goho, reviewed the work of the past year in an interesting address.

Touching the status of the industry, he said: "I know of no organization of manufacturers in any line which stands more firmly and consistently for quality than does the sand-lime brick industry. The ever-present question has been how to make better brick, and when questions of economy in operations have been debated, it has always been taken for granted that they were not worth consideration if they involved a product in the slightest degree below the best. There is no doubt that this attitude of our members is a permanent one. It will become stronger as the years go by, and this Association will do more than its share in establishing high standards of honor and service in building material. On the other hand there are some considerations worthy of note at this time suggested by certain tests reported at our last meeting. There is in them no great reason for discouragement and not the slightest reason for alarm. All data regarding building material has value only when the data is compared with data regarding similar material.

"Now it is the policy of this Association to refrain from fault-finding and criticism when discussing the merits of our product as compared with clay brick. Many of our members have had no experience with clay brick, but those who have know that makers of clay brick have troubles of their own. Some years ago a public school building was under construction in this city. The contractor bought and stacked on the job about 500,000 hard burned shale bricks. The contractor met financial reverses and abandoned the contract. While the re-letting of the contract was pending, the brick stacked in piles, went through an ordinary winter. The new contractor took over the brick, expecting to get 500,000 brick. With the advent of spring it was found that the hard-burned shale brick had turned to dirt and it wasn't good, clean dirt at that. The factory that made these brick is still working. There was no demand for it to make good. So far as I know the incident has not interfered with a single sale for the plant, and aside from a few persons directly interested the affair passed without notice.

"I have seen hard-burned shale brick dumped on the job, hot from the kiln, break and split while still hot, until the pile seemed to have a creeping, crawling, sort of life. I have seen clay brick stacked under cover at the kiln turn to dirt piles over winter, but I have yet to know of a plant that closed down for this reason.

"I refer to these things, not to find fault with clay brick, but to emphasize the fact that in the midst of entirely new problems of manufacture, management and marketing, we are making magnificent brick and making new standards—standards to which the other fellow will some day have to measure up."

Sand-Lime Brick in Canada

Of the various papers presented, Canadian interest centred on "Sand-Lime Brick in Canada," by Mr. W. H. Terry, of the Harbor Brick Company, Toronto. There was a full discussion on this paper opened by Mr. W. D. MacFarlane, of Winnipeg. At the election of officers Mr. S. O. Goho, of Harrisburg, was re-elected president, and Mr. W. H. Terry, of Toronto, vice-president. Mr. George Silvester, of Calgary, was elected District Representative for Canada. The next annual meeting will be held at Dayton, Ohio, December 8-9, 1914. It will be recalled that the 1912 convention took place in Toronto, the sessions being held at the King Edward Hotel.

Personal Mention

Professor L. A. Herdt, of Montreal, has been appointed to report on electrical conditions in the city of Quebec.

Mr. F. C. Gamble has been elected for the third year to the chairmanship of the Victoria, B.C., Branch of the Canadian Society of Civil Engineers.

Mr. A. R. Tibbits, of Ottawa, inspecting officer of harbor commissions, has reached Vancouver to assist the harbor commissioners in permanently organizing in that city.

Mr. J. D. Breckon will probably be appointed to take charge of the Vancouver waterworks system under the superintendence of the City Engineer, Mr. F. L. Fellowes.

Mr. Thos. Seidl, chief engineer for Messrs. Escher Wyss & Company, Montreal, is visiting the headquarters of his company at Zurich. He will be absent about a month.

Mr. H. B. A. Vogel, of South Vancouver, has been appointed secretary of the newly created North Fraser Harbor Commission, which will attend to the harbor development works.

Mr. A. K. Robertson, C.E., Vancouver, has been elected a Member of the American Society of Civil Engineers. Mr. C. E. Bee, Division Engineer, Southern Alberta Land Company, becomes an Associate of the same body.

Mr. T. H. Hogg has been appointed to represent the graduate body of the Faculty of Applied Science on the Senate of the University of Toronto. The appointment is made to fill the vacancy caused by the resignation of Mr. C. H. Mitchell.

Mr. C. B. Vorce has severed his connection with the British Columbia Electric Railway Company for whom he was construction engineer for three years. It is expected that he will enter the consulting engineering field in New York City.

Mr. R. H. Cunningham, B.A.Sc., the new manager of Canadian Hoskins, Limited, Walkerville, Ont., was connected for several years with the Hoskins Manufacturing Company of Detroit, and received his present appointment upon the opening of the Canadian branch factory.

Mr. J. W. Helps, late Industrial Engineer Toronto Hydro-electric System, read an interesting paper on "Scientific Illumination" at the last monthly meeting of the Central Railway and Engineering Club of Canada, held in Toronto. The paper was illustrated with lantern views.

Mr. W. G. Gordon has been appointed Transportation Engineer for the Canadian General Electric Company, Limited, and will take charge of all inquiries in connection with electric traction. He has had wide experience in connection with not only city and inter-urban electric traction, but also trunk line electrification. He is a graduate of Cornell University.

Messrs. A. M. Grace, W. D. L. Hardie and Arthur Reid have been appointed Commissioners of Lethbridge, which city is just entering upon the commission form of municipal government. The Lethbridge charter provides for three commissioners, and it is significant that the new Commissioners are all engineers. Mr. Hardie, who is mayor of the city, is a civil and mining engineer; Mr. Reid, Commissioner of Public Utilities, is an electrical engineer; and Mr. Grace, Commissioner of Public Works, is a civil engineer.

Mr. J. E. Griffiths, Public Works Engineer, will be appointed by the Federal Government Deputy Minister of Public Works, in succession to Mr. W. W. Foster. Mr. Griffiths has been in the Government service since 1897, and for sixteen years prior to joining the Public Works department was employed by the Canadian Pacific Railway on construction work west of Winnipeg, when the first steel was laid, and later as resident engineer between Donald and Kamloops. Some five years ago he was loaned by the Government to the Canadian Pacific Railway Company, who, in turn, despatched him to South America to enter the employ of the Trans-Canadian Railway Company, in connection with winter operations over the Andes and the construction of large snowsheds there.

Canadian City Engineers

Mr. S. B. Bennett, Nanaimo, B.C

The present city engineer of Nanaimo, B.C., Mr. S. Barlow Bennett, was born at Burslem, Staffordshire, Eng., and was educated at Earl Granville's School and The Endowed School, Newcastle-on-Tyne. He served an apprenticeship in sanitary engineering and afterwards took a three years' course at the Municipal School of Technology, Manchester, where he became a silver medallist. Later he entered the Armstrong College at Newcastle-on-Tyne and spent several years in the chemical laboratory, chiefly with a view to studying chemistry as applied to engineering and the analysis of water supplies. Later he took the civil engineering course leading up to Intermediate Science. For several years he practised drainage engineering in Manchester and acquired considerable experience in the reconstruction of slum areas, town planning, sewerage and other municipal work. Next he obtained an appointment as sanitary expert to the Durham County Council, which was followed in 1911 by his acceptance of the city engineership of Nanaimo.

City Engineer Bennett, of Nanaimo, B. C.

Mr. Bennett is a member of the Royal Sanitary Institute, the Institute of Sanitary Engineers and the Technical Teachers' Association. He has been a frequent contributor to the technical press and is the author of a well-known book on practical sanitary science. Much of his leisure time is devoted to research on "Dangerous Occupations," a topic upon which he has lectured before a number of societies. Mr. Bennett has not become a sanitary expert by devoting himself exclusively to this special study for he confesses to having certain hobbies, foremost among which is the making of geological microscopical sections.

Sir William Henry Bailey, chairman and managing director of W. H. Bailey & Company, Limited, Salford, Eng., and one of the pioneers of the Manchester Ship Canal, died recently.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

For the past year the building permits of Maisonneuve, P.Q., totalled $2,337,323.

The Mimico village council decided at its last meeting to invite the ratepayers of Mimico to take a plebiscite on the question of a waterworks and sewerage scheme for the district.

Extensions to the Berlin waterworks system, costing $100,000, are practically completed, and water from nine artesian wells is now pumped by hydro power instead of steam plant.

The extensive stone crushing plant of the Canadian Northern Railway at the western portal of the Mount Royal tunnel has been destroyed by fire. The machinery has been badly damaged.

The Dominion Textile Company is to erect a new mill and make a large extension to its present structure at Montmorency Falls. The mill will cost in the vicinity of $750,000, and work will be commenced next summer.

At Hamilton, recently, Judge Snider gave judgment for the full amount in an action brought by Messrs. Mills & Hutton, architects, for $529, balance due for work in connection with remodelling the basement of the Hamilton city hall.

Messrs. P. H. Secord & Son, Brantford, have received the contracts for erecting the new public school at Port Dover, to cost $28,000, also for building the new armories at Haileybury for the Federal Government, at a cost of $36,000.

A new road, to be known as the Norfolk and Elgin Railway, will apply for incorporation next session. It will commence at Simcoe, Ont., and will extend to a point within three miles of the shore of Lake Erie and thence to Port Burwell, Ont.

The Canada Cement Company's new mill at the east end of Montreal, which has but recently gone into operation, has a daily capacity of 12,000 barrels. This brings the total capacity of the entire company's plants to approximately 12,000,000 barrels a year.

The ratepayers of Port Arthur have been asked to vote on a proposed by-law to authorize the issue of debentures for $202,167 for the extension of the waterworks system of the city; also for $75,000 to provide for the erection of a courthouse and jail for the district of Thunder Bay.

The Engineers' Club of Montreal have formally opened the extension to their premises in Phillips Square. The addition and the partial reconstruction of the old house have been made necessary by the growth of the membership which now numbers 480. Mr. H. H. Vaughan presided at the opening dinner.

It is announced that the Canadian government has purchased three miles of the most valuable portion of the harbor front of Quebec city at a cost of $250,000. The government is said to have under consideration extensive plans for its development. Details may be announced at the coming session of parliament.

It is estimated by Mr. George Janin, chief engineer of the city of Montreal, that the purchase of materials for the public works department next year will cost the city $1,227,104. Of this sum $835,104 will be needed for paving material, $19,500 for bricks for sewer work, and $372,500 for purchases in connection with the laying of new water mains.

According to official information from Ottawa the main feature of the public works carried out during the past season has been harbor improvements. The total appropriation for this purpose amounts to $28,214,000. This sum covers harbor dredging and river work. Seventeen million dollars will about represent the amount spent by the end of the present fiscal year.

A report from Ottawa states that the next waterway scheme which the government will undertake is the new Sault Ste. Marie canal. It is understood that an appropriation will appear in the estimates of the Minister of Finance to begin work. The new Soo canal is part of the government plan to furnish a waterway from the Atlantic to the head of navigation on the Great Lakes.

It is rumored that Judge Winchester's recent report on the investigation of Toronto schools may be followed by litigation on the part of the Board of Education against certain contractors who were alleged to have used material inferior to what was called for in the specifications. In the matter of the radiation and carpentry contracts, the judge estimates the loss as the result of shortages at $23,637.

In reply to a communication from the Montreal Builders' Exchange, advocating a Federal bankruptcy law, the Hon. C. J. Doherty, Minister of Justice, expresses the opinion that such a law is desirable. The Exchange pointed out that at present each province has its own law, with consequent confusion to business men distributing goods over the whole Dominion. Mr. Doherty has promised to lay the matter before the Cabinet, and adds: "Personally, I am of the opinion that such a law, provided its provisions be carefully considered and adapted to the needs of the country, would be highly desirable."

An action by the Ambursen Hydraulic Construction Company of Canada, Limited, Montreal, against the Donnacona Paper Company, Quebec, has been settled by consent. The plaintiffs entered into a contract to construct a dam for a hydro-electric development on a 15 per cent. basis, but after two months' work were stopped, on the ground that the methods were too costly. The plaintiffs thereupon sued for breach of contract and for damages, and the defendants entered a counter-claim for a large amount. Under the settlement the Ambursen Company will receive $16,000 for commission and an agreed sum for damages, the counter-claim being withdrawn.

The Asbestos Manufacturing Company, Limited, of Montreal, recently held a two days' conference of salesmen and branch managers at their Montreal offices in the E. T. Bank Building. The discussions included a paper on Asbestos Textiles by Mr. H. V. Everham, Jr., of Boston; a discussion on Asbestos Pipe Coverings and contract covering work by Mr. F. F. Cooper, of New York City; addresses on the manufacture and uses of Linabestos, their new wall covering, and other items of manufacture of this company. The representatives were entertained by the company at luncheon on the

11th, and on the same afternoon an inspection trip was made to the large plant at Lachine. The convention was concluded by a dinner.

The contract for the new factory for the Canada Nail and Wire Company, Limited, which is to be located at Coldbrook, near the Ford Motor Company's plant, three miles from St. John, N.B., will be awarded as soon as the company has received its charter. The structure will probably be of brick. A new warehouse has just been completed to accommodate the traffic of the Red Cross Line steamer between St. John and New York. This is only a weekly service started in the autumn, but the steamer is doing a steadily growing business. The Partington Pulp and Paper Company have considerably enlarged their St. John plant this year and are now completing a new warehouse and a conveyor to carry the pulp from the mill to the warehouse.

According to the annual report of the Dominion Bridge Company, the net profits for the year were $832,778. The output of the various plants were 76,073 tons, an increase of 13,026 tons over the previous year, which would have been considerably larger but for the congested condition of all steel mills during the early portion of the year. The value of the business entered during the year was $6,500,000, and the gross value of the contracts charged up $5,621,000. Work to the value of $8,650,000 is being carried forward into the new year. Extensions were carried out at the Lachine, Winnipeg, Toronto, and Ottawa plants. The following officers were elected: President, Phelps Johnson; first vice-president, G. H. Duggan; second vice-president, F. L. Wanklyn; directors, R. B. Angus, Chas. Cassels, Norman Dawes, C. B. Gordon, J. K. L. Ross, J. M. McIntyre, H. W. Beauclerk; secretary-treasurer, R. M. Davy.

WESTERN CANADA

It is announced that an order has been placed with Cranbrook, B.C., quarrymen for the delivery of cream-colored marble to be used in the construction of the new $300,000 Morman Temple at Cardston, Alta. Work on the structure starts in the spring.

Contractors are now preparing to put in the coffer dam on the new $450,000 arch bridge over the river at 25th street, Saskatoon, Sask. Work will be pushed throughout the entire winter and in the spring a large gang of men will be employed. The bridge in question will connect the city with the provincial university.

Work is expected to begin by January 15 on the construction of a new store for the Hudson's Bay Company at Victoria, B.C. The first four storeys will involve an outlay of $450,000. Tenders for the work were received up to December 27, and these will be gone into at once under the superintendence of Mr. Burbidge, commissioner of works.

The Geijsbeek Engineering Company, clayworks engineers, Portland, Ore., have let the contract for two large factory buildings for the B. C. Pottery Company, Limited, at Victoria, B.C. The contract was awarded to C. W. Carkeek & Company, of Victoria, and amounts to $14,000. These buildings will be used for the manufacture of high glazed sewer pipe, drain and partition tile.

In their town planning scheme which the Saskatoon city commissioners will submit, it is proposed to restrict business enterprises to certain sections of the city, except in cases where two-thirds of adjoining property owners sign a petition asking for a store in a purely residential district. The scheme will also make impossible the erection of shacks on property adjoining good residences. It is possible that apartment houses will only be permitted on business streets, but this point has not been definitely settled. The Parks Board is to ask the government for a grant of $30,000 as an instalment for 1914.

Canadian Railroad Development

The new Canadian Northern line between Toronto and Ottawa will be ready to receive regular freight business on January 3.

The Southampton railway extending from Millville to St. John River, N.B., a distance of thirteen miles, is stated to have been granted a double subsidy of $6,400 a mile by the federal government.

According to Mr. B. B. Kelleher, chief engineer, the driving of the last spike on the Grand Trunk Pacific may be expected in April next. The eastern and western ends of the line will be connected about one hundred miles west of Fort George.

The Hon. Frank Cochrane has signed the agreements for the carrying out of the big terminal works undertaken by the city of Quebec. These involve the construction of both union and freight depots, for the joint use of the G. T. R. and C. P. R., extensive car shops at St. Malo and a large freight yard at St. Foye. In addition a tunnel is to be built between the union station and the one situated on the harbor front.

A grand total of 1,700 miles of railway has been under construction during this season by the C. P. R., according to a statement made by Mr. J. G. Sullivan, chief engineer of the western lines of the company, on his return to Winnipeg after an extended tour of the work. The amount of work handled by the construction department of the company, which totals 30,000,000 cu. yds., represents more material than was moved during any period in the construction of the Panama Canal.

The government intends giving the Grand Trunk Pacific Railway a further guarantee of $2,000 a mile and in addition $1,300,000 to cover the cost of two railway projects, one of which is on the line from Young to Prince Albert. The Hon. J. H. Calder, Minister of Railways in the Saskatchewan legislature, has announced that the work on the Grand Trunk Pacific project over the Saskatchewan River will be commenced this month. All the grading of the line has been completed to a point within the city limits of Prince Albert.

The most important move in connection with the development of terminal facilities at Courtenay Bay, N.B., since seventy acres were purchased as a site for terminals for the Grand Trunk Pacific, was taken when plans were filed at the registry office for a right-of-way one hundred feet wide from a point a little over a mile from the city, on the line of the Intercolonial Railway, to a point on Courtenay Bay, at the foot of Egbert Street. It is estimated that this right-of-way will cost between $150,000 and $200,000. Nearly all of the property needed is under option, but some must be expropriated. This spur line will contain three crossings, all of which it is said will be overhead. It is believed that this action has been taken in order that the St. John Valley Railway may come to terminals at Courtenay Bay; and, as the St. John traffic of the Grand Trunk Pacific is expected to come over the St. John Valley Road, this spur would be used in connection with the traffic of that road as well.

Obituary

Mr. Thos. Sinclair, a well-known Brandon architect, died very suddenly on December 19. He had only returned from St. Boniface hospital about two weeks- before his death.

Mr. Charles S. Musson, travelling freight agent for the Nickel Plate Road in Chicago and an old-time constructing engineer on Canadian railroads previous to 1888, died December 14 at Wilmette, Ill.

Sasgen Derricks and Winches

The Sasgen Derrick Company, 13 Jarvis Street, Toronto, are patentees and manufacturers of builders and contractors' derricks and winches of the most practical and up-to-date type. These derricks are all fitted with steel and malleable castings which make the machines light while at the same time adding materially to their strength. The Sasgen Peerless circle swing steel derrick is claimed by the makers to be the most practical and convenient derrick for hoisting building material of various kinds. It is a full circle swing, portable, steel derrick with self-lubricating bearings, folding mast and bottom, and can be used by hand, horse or power without changing the boom. This derrick, when taken apart, is light and compact enough to be placed in your automobile to remove from job to job.

The Sasgen reinforced circle swing derrick for building and structural work is claimed by the manufacturers to be absolutely unrivalled. The derrick is so constructed that it can be used by hand or power. The Sasgen stiff-legged derrick is built with a split mast and boom and is equipped throughout with all-steel fittings, as also are the gears and frame of their double drum hoisting winch. Other makes include the Pole derrick, used extensively by carpenters and masonry contractors, and Top Point and setter derricks, which are an improvement, in many ways over the old setter derricks. This progressive firm also manufacture single and double drum geared winches, which are made from malleable and crucible steel, including gears, and are equipped with band brakes, the double drum having a special lever for shifting pinions into or out of large gears, by which means both pinions are worked simultaneously.

The Sasgen Derrick Company will ship these machines to reliable or rated contractors on trial. Special illustrated pamphlet and price list will be mailed upon request.

We have received from Messrs. Lecky & Collis, Limited, sole Canadian agents for Messrs. Swift, Levick & Sons, Sheffield, Eng., a copy of a particularly interesting catalogue of tool steels, drill steels, files, drills, etc., issued by the latter firm. The publication is styled a catalogue but it is more in the nature of a printed manual on the manufacture of steels and methods of use. It is well illustrated and contains a number of useful tables. Among the interesting features is a description of the "Wakfer" patent file which is said to be the invention of a practical engineer and is designed to give a greatly increased cutting power, requiring the minimum of labor in working. Clogging of the teeth of the file is prevented by means of graduated clearance tunnels which greatly enhance the efficiency of the tool. The head office of Messrs. Lecky & Collis, Limited, is at Napanee, Ont., and the firm has a branch office and warehouse at Montreal.

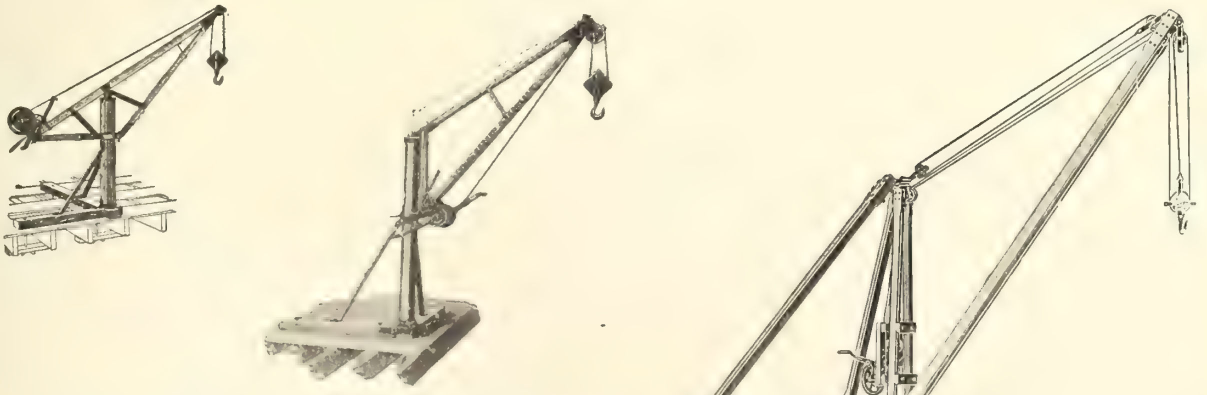
In an article relating to the new Y. M. C. A. building at Brantford, published in our special number devoted to brick and clay products (December 10, 1913), it was stated that the pressed brick were furnished by the Milton Pressed Brick Company, but we are now advised that the Toronto Pressed Brick & Terra Cotta Company were the contractors for the brick.

Messrs. Siemens Company of Canada, Limited, have favored us with one of their 1914 diaries which is provided with all the accessories which go to make up a good diary and in addition contains a host of useful trade information. The diary is gilt-edged and bound in red morocco.

The annual meeting of the Manitoba Branch of the Canadian Society of Civil Engineers was held recently in Winnipeg when Professor Brydone-Jack was elected chairman (in succession to Mr. J. G. LeGrand), and Mr. G. E. Bell, secretary-treasurer.

The tenth annual convention of the National Association of Cement Users is scheduled to be held in Chicago, February 16-20 contemporaneously with the National Conference of Concrete Road Building. Mr. E. E. Krauss, Harrison Building, Philadelphia, is Secretary of the Convention, and Mr. J. B. Beck, 72 West Adams Street, Chicago, is Secretary of the Conference.

A particularly appropriate souvenir, combining the qualities of attractiveness and originality, is to hand from the Canadian Supply and Contracting Company, Limited, Toronto. This takes the form of a plated combination desk calendar and clock. The date numerals and months of the year are printed upon revolving pads, whilst the clock is of just the dimensions to render it both useful and ornamental without being too conspicuous on the office table. The Canadian Supply and Contracting Company, Limited, whose headquarters are in the Nicholls Building 220 King Street West, Toronto, are well-known as structural water-proofing engineers and contractors, dealing in roofing, water-proofing and insulating material.



Types of derricks manufactured by the Sasgen Derrick Company, Toronto. From left to right: reinforced derrick, Peerless derrick and stiff leg derrick.

The Manufacture of Sand-Lime Brick at St. Lambert, Que.

THE enormous increase of building in the Montreal district has naturally resulted in a heavy demand which last year was only partially met by local yards. The outcome is an increase in the number of brick-making plants, and more active competition for business. One of these plants was built by the Canada Brick Company, Limited, with head office in the Transportation Building, Montreal. The president is Mr. C. H. Cahan, K.C.; the vice-president Mr. H. A. Lovett, K.C.; the directors, Messrs. R. Brutinel, G. F. Gyles and A. G. Cameron, and the manager, Mr. B. F. Bowler. The issued capital is $500,000.

The plant is at St. Lambert, P.Q., on the south shore of the St. Lawrence, and occupies a site with excellent shipping facilities, a siding of the Grand Trunk running into the works. Operations were commenced in July, 1912, but it was found necessary to remodel a portion of the plant, and it was in January of this year that bricks were produced on a market basis. Sand lime bricks are manufactured—and these are made on the Division method. The process, which is patented, is used in Russia, Germany, and the United States. It consists of mixing, in certain proportions, lime, ground sand, and unground sand, so as to make a firm sound brick, with the requisite bonding qualities. The brick has been found to have a crushing strength of three tons per square inch, with an absorption of 9.7. It is claimed that the cost is low, that the bricks are regular in size, that the grey effect is pleasing, and that the product is more durable and more fire-resisting than the ordinary plastic brick. It is also claimed that owing to the uniformity of the brick a saving of from ten to twenty per cent. can be made in the labor on structures built of the Dominion Silicate brick. The weathering qualities are stated to be excellent as they harden with age, and frost has no deteriorating effect. The sand comes from South Durham, P.Q., and the silicate lime, 100 per cent. pure, from Phillipsburg, P.Q.

The buildings and yard at St. Lambert are 400 ft. long and 150 ft. wide. The plant is housed in a building of two storeys, the greater portion of the machinery being situated on the ground floor. It is capable of turning out 40,000 bricks a day. The sand is elevated from the railway cars into a sand bin on the upper floor, and from there is conveyed on a belt into the dryer, from which it falls into an elevator boot, and is again elevated. From there it is conveyed to the tube mill below; lime is also sent down from a second shoot, and these two materials are ground in the mill by means of a number of pebbles.

The lime is stored in a separate shed, and after being crushed is sent to the upper floor by a canveyor, and thence, as previously stated, it goes into the tube mill. When the ground mixture of sand and lime leaves the mill it is in the form of a fine flour, and as it passes into a mixer there is added a proportion of unground sand. Water is also added to hydrate the lime, and when the three constituents have been thoroughly mixed they are elevated into a huge steel cone-shaped silo. This has two divisions, and the material is stored in one of these for twenty-four hours before being used; the second contains the material which is required for immediate use. The material is conveyed from the silo by a belt, and is then given a thorough and final mixing. Once more it is elevated, from which point it comes down to the rotary press, turning out 22,000 bricks per day of ten hours.

When thus pressed into firm shape, the bricks are loaded on to trucks, containing 1,000 bricks. As soon as a truck is filled, it is run on rails to the other end of the building to the hardening cylinders, two of which are in operation when the plant is fully occupied. The cylinders are 65 feet long, with rails on the bottom, and are capable of receiving 22 trucks, or 22,000 bricks. The trucks are run in, the cylinder sealed by means of a tight-fitting iron door, and steam turned on. Here the bricks remain twelve hours and are thoroughly cooked, after which they are taken out and shipped or stored. The empty trucks are sent back, by means of transfer tracks, and a return track, to the moulding machine.

Both steam and electric power are used. The boiler generates steam for the hardening cylinders, and sand dryer, and for heating the building. Electricity is supplied by the Montreal Light and Power Company, three motors being installed. The tube mill, elevators, mixers and press are run by this power, which is also used to light the building.

The chief portion of the machinery was supplied by the Berg Machinery Manufacturing Company, Toronto, this including the sand dryer and the hardening cylinders; the tube mill came from Canadian Allis-Chalmers, Limited; the press was made by the American Clay Machinery Company, Willoughby, Ohio; and the lime crusher by the Sturtevant Mill Company, Boston.

The Canada Brick Company have made housing provision for their employees by erecting two houses near the plant. One is a fairly large building, one end being occupied by the married men and the other by the unmarried men.

During the present year the company have supplied brick for some of the largest structures in Montreal, as well as sending their products as far west as Deseronto, Ont. The Montreal buildings include the new Protestant High School, Grenadier Guards new Armoury, Bank of British North America, and the Versailles Building.

So successful has the use of burned earth material for ballasting railroad tracks proved in Texas and other parts of the south-west that the Missouri, Kansas & Texas Railroad Company recently entered into contract with Butler Bros., of Dallas, for the burning of more than one million cubic yards of this class of road surfacing. It is stated that approximately $1,700,000 is involved in this contract. It is the largest award of the kind ever made in that part of the country. The material will be sufficient to ballast about 600 miles of railway in Texas. The contractors will erect kilns or burning pits at Hillsboro, Granger, Reedville and Rogerville, all in that state. It is estimated that it will require approximately 250,000 tons of lignite coal to burn the tonnage of earth specified in the contract. The raw material will be obtained from the surface of large tracts of land which have been leased for the purpose.

The great man is not he who has been favored with opportunity but he who has made opportunities for himself.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Campbellton, N.B.
Quotations f.o.b. Campbellton are required by town council for the following road machinery: 15-ton steam road roller; stone crusher, capacity 20 to 25 tons per hour, complete with elevator and screens; portable engine and boiler, 20 h.p.; spreader wagon. Clerk, J. T. Reid. Engineer, R. J. S. Sly.

Toronto, Ont.
The following paving is planned by the Board of Control. Commr. of Works, R. C. Harris. General contractors, Constructing & Paving Co., Confed. Life Bldg., $2,929. Asphalt on Janet Ave., transferred from Commr. of Works, also concrete curb on Melgund Rd., at 41c per lineal ft.

The Board of Control recommends construction of 6-in. duplicate water main on west side of Carlaw Ave., from Bay to Gerrard St., at an estimated cost of $6,340. Commr. of Works, R. C. Harris.

The Board of Control, have recommended the construction of a sewer on O'Connell Ave., by day labor. Commr. of Works, R. C. Harris.

Vernon, B.C.
A report has been submitted to the Municipal Council regarding the extension to the sewage system, etc. The estimated cost is $90,000. Clerk, D. G. Tate. Consulting Engineers, Cummins & Agnew.

Windsor, Ont.
The Water Commissioners have applied for an order in council to permit the laying of a new intake pipe opposite the present waterworks site. Clerk to Council, Stephen Lusted.

Winnipeg, Man.
Tenders will be received until 8th Jan. for the supply of the following cast-iron water piping, required by Board of Control. 35,000 ft., 6-in. pipe; 6,500 ft., 10-in. pipe; 2,000 ft., 12-in. pipe. Specifications, etc., at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Tenders will be received until Jan. 8th for the following sewers, planned by the Board of Control. Ash St. from Godfrey to Haskins Ave., and Haskins Ave. from Oxford to Ash St. Specifications at office of Engineer. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St.

Tenders will be received until Jan. 2nd for the following valves, required by Board of Control. 300 6-in. valves for domestic water works system. Specifications, etc., at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Stamford Twp., Ont.
Waterworks equipment planned by Twp. Council. Clerk, Carleton Munroe, Southend. Engineer, C. Gardner, Niagara Falls. Hydrants, The Darling Pump Mfg. Co., $3,380. Valves, Canadian Fairbanks-Morse Co., Ltd., 26 Front St. W., Toronto.

Toronto, Ont.
Concrete sidewalks planned by Board of Control. Commr. of Works, R. C. Harris. Contracts transferred from Commr. of Works to following:—General contractor, H. Mitchell, 464 Brock Ave., Bracondale Rd. General contractors, Queen City Concrete Paving Co., 179 Broadvnew, Gertrude Place. A. Johnson, 35 Burgess Ave., Ossington Ave. All at $1.14 per lineal ft.

Grading planned by Board of Control. General contractors, Grant Contracting Co., Front St. E., Braemore Gardens, $1,295. A. Johnson, 35 Burgess Ave., Hiawatha Ave., at $220. Ramsay Contracting Co., 39 Indian Rd. Cres., McGregor Ave., at $574.50.

Cast-iron pipe required by Board of Control. General contractors, National Iron Works, Toronto, 6-in. pipe, at $7.40 per length. General contractors, Can. Allis-Chalmers Co., King W., 3-in. pipe, at $5.00; 4-in., at $4.60; 8-in., at $10.00; 10-in., at $14.00; 12-in., at $19.00 per length.

Railroads, Bridges and Wharves

Asphodel Twp., Ont.
The location of C. P. R. shelter station on E. ½ on lot 18, con. 4., has been authorized.

Montreal, Que.
Hutchison, Wood & Miller, Royal Insurance Bldg., as architects for the owners, are receiving tenders now to replace corner of R. MacFarlane & Co.'s building at St. James and Richmond Sts., recently destroyed.

North Timiskaming, Que.
Bridge planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until Jan. 12th for sub-structure and approaches of highway bridge. Plans, etc., at offices of Dist. Engineer., Confed. Life Bldg., Toronto, Post Office, Montreal, and Postmaster at North Timiskaming. Works consists of: (a) 3 concrete piers on piles and stones; .b) 2 concrete abutments with wing walls; (c) reinforced concrete culverts; .d) 2 earth approaches; 10,600 cu. yds. dry excavation; 5,200 lin. ft. piles; 70,000 M.B.M. timber (hemlock, spruce, cedar or pine). The above is for a 2-span bridge 480 ft. long. Superstructure of steel is not included in this tender.

Province of Nova Scotia
Tenders will be received by Dominion Govt., Dept. of Railways & Canals, Secretary, L. K. Jones, Ottawa, until Jan. 6th, for the construction of a line of railway from North Sydney to Leitches Creek. Plans, etc., at office of Station Master, North Sydney, Chief Engineer, Moncton, and at Dept., Ottawa.

Ottawa, Ont.
Work on the Morrisburg & Ottawa Railway has been postponed until spring. Secretary, R. S. Bishop, Canada Life Bldg. General contractors, R. J. Tierney Company.

Port Stanley, Ont.
It is understood that a site is to be deeded to the Government by the London & Port Stanley Railway Commsn., to provide for the erection of a freight shed.

Vancouver, B.C.
The Dom. Govt. Dept. of Public Works, Sec., R. C. Desrochers, Ottawa, contemplate the construction of a bridge to span False Creek, from the "Reserve" to mainland opposite.

Westville, N.S.
A brick construction extension to the waterworks pumping station is contemplated by town council. Clerk, Alex. W. McBean.

CONTRACTS AWARDED

College Bridge, N.B.
Station, cost $4,300, planned by the Intercolonial Rly. General manager, F. Gutelius, Moncton, N.B.. General contractors, Gaudet & Dupuis.

Ottawa, Ont.
Pontoon bridge, cost $7,895, Bank St., planned by City Council and County of Carleton. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractor, John Lowry, Pretoria Ave.

Roy's Beach, B.C.
Wharf, cost $6,300, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, R. H. Wood.

Westville, N.S.
Freight shed, cost $1,750, planned by Intercolonial Rly. General manager, F. Gutelius, Moncton, N.B. General contractors, McLeod & Simms.

Public Buildings, Churches, Schools, etc.

Brighton, Ont.
A new school will probably be erected next summer by the Municipal Council. Clerk, A. Mark.

Chilliwack, B.C.
The council have submitted to the ratepayers a by-law asking for authority to raise by debenture the sum of $22,000 to be applied towards the construction of two new schools, one at Sardis

and one at Rosedale, and to build an addition to the school building at Atchelitz.

The township authorities are seriously considering the advisability of erecting a new town hall. A site for the building will probably be selected near the city and a by-law submitted for authority to raise the necessary funds by debenture.

Charlottetown, P.E.I.
A site has been purchased by the St. Dunstan Cathedral authorities upon which it is proposed to erect a Hall for the League of the Cross Society. It is probable that some time will elapse before a start is made on this building.

Haileybury, Ont.
A new edifice with parsonage will be erected next spring by the congregation of the Baptist Church, of which the Rev. R. M. Carkner is Pastor.

Kamloops, B.C.
A by-law to provide $15,000 for the Royal Inland Hospital has been introduced by the City Council.

London, Ont.
Lord Roberts Chapter Daughters of the Empire propose erecting an ornamental granite fountain to commemorate Queen Victoria. Pres., Mrs. E. B. Smith, Worthy Rd. Vice.-Pres., Mrs. Dr. Niven, 423 Colborne St.

Ottawa, Ont.
Tenders will be received by Dominion Government, Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, until 4 p.m. Jan. 14th, for a stone construction addition to the Royal Mint Refinery, Sussex St. It is estimated that the cost will be $100,000.

Additions to university estimated to cost $150,000, are planned by the University of Ottawa. Sec., Rev. J. L. Binet. Architect, C. P. Meredith, 126 Sparks St., who expects to call for tenders first 2 weeks in January. Four storeys, 130 x 52, Indiana limestone and reinforced concrete construction.

Ottawa, Ont., Eastview
A by-law will be submitted to ratepayers on Jan. 5th for endorsement of the proposal to erect a Town Hall, Fire and Police Station, at a cost of $25,000 to $30,000. Mayor, C. Gladu, McArthur Rd.

Port Alberni, B.C.
Public building planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. Tenders received by Minister until 4 p.m. Dec. 31st. Plans, etc., at office of Wm. Henderson, Res. Engr., Victoria, Postmasters, Port Alberni and Nanaimo and Caretaker, Public Bldg., Vancouver.

Regina, Sask.
The Regina Trades & Labor Council, St. John and Tenth Ave., propose erecting a 2-storey labor temple, at an estimated cost of $30,000. Sec.-treas., W. E. Coch, 1852 St. John St.

St. Catharines, Ont.
The St. Thomas Anglican Trustees have under consideration the erection of a new Sunday school. Two storeys, 40 x 70, brick construction, stone foundation, asbestos roofing, electric lighting, steam heating, maple floors. The estimated cost is $12,000. Architect, Joseph Daw, 165 St. Paul St.

The congregation of the British Methodist Episcopalian Church have decided to make certain alterations to their church building. Two storeys, 16 x 26, frame construction, stone foundation, shingle roofing, hot air heating, hard wall plastering, also to build a rectory, frame construction, stone foundation, shingle roofing, hot air heating plate glass. Architect, Joseph Daw, 165 St. Paul St.

Sydney, C.B.
The Y. M. C. A. authorities are contemplating a new building.

Toronto, Ont.
Congregations of St. Enoch's and St. Gile's Presbyterian Churches are to be amalgamated shortly; building to include club rooms, gymnasium, etc., is contemplated. Pastor of St. Enoch's, Rev. Robt. Hamilton, 45 Isabella street.

Tenders for Hester How School addition were not opened by Board as the city refused permission to erect additions.

Vancouver, B.C.
Lodge Hall, Homer street, for Fraternal Order of Eagles. Architect, Emil Guenther, Northwest Trust Bldg. Three storeys, part basement, 120 x 50, brick construction. Plans are being prepared and work is to start early next spring.

Victoria, B.C.
The Dom. Govt. Dept. of Public Works has purchased a site bounded by Blanchard, Collinson and Burdette Sts., for the erection of a court house. Sec., R. C. Desrochers.

Westville, N.S.
A fire hall and hose-drying tower is contemplated by town council. Clerk, Alex. W. McBean.

Wilkie, Sask.
A site has been purchased cor. Main and Imperial streets, by the Dominion Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, for the new post office. It is estimated that the cost of the building will be $35,000.

CONTRACTS AWARDED

Vancouver, B.C.
Addition to hospital, cost $199,921, planned by General Hospital Board. Managing Sec., Geo. Haddon. Architect, A. A. Cox, Carter-Cotton Bldg. General contractors, Baker, Whipple & Campbell. Three storeys, mill and brick construction.

Business Buildings and Industrial Plants

Aylmer, Que.
Plans are to be prepared for dairy farm buildings for Silver Springs Dairy Farms, Ltd. (formerly Clark's Dairy, Ltd.). Architect, C. P. Meredith, 126 Sparks St., Ottawa.

Blenheim, Ont.
Guild & Connor have decided to erect a two storey cement block building with a frontage of 50 feet on Talbot street and 104 feet on Marlboro street, with a depth of 75 feet. The upper floor will be provided with a large lodge room.

Chemainus, B.C.
Machinery has been purchased for a sawmill with a daily capacity of 50,000 ft. which P. Welch, 325 Howe St., Vancouver, proposes to erect on the Pacific Great Eastern Ry. Engineers, J. B. Weir & Co., 737 Pacific St., Vancouver.

Ft. William, Ont., Mt. McKay
Ratepayers will vote on by-law to raise $30,000 for the purpose of acquiring, establishing and equipping stone quarry, and to construct and equip an extension of the street railway to such quarry. Clerk, A. McNaughton.

Grimsby, Ont.
Alterations to stores and printing office proposed by J. A. Livingston & Son. West wing, 148 x 40, east wing, 60 x 40, plate glass, store fronts. Plans in progress.

Hamilton, Ont.
The Arcade, Ltd., Manager J. P. Whelan, 43 James St. N., propose making an addition of two storeys to their store. Architect, W. A. Edwards, 7 Hughson St. S.

G. W. Robinson & Co., James St. S., propose: to build 2 additional storeys, structural steel and brick construction, felt and gravel roofing.

The Park Theatre Co. (B.' G. Anderson, Buffalo, N.Y.)., have obtained license to build a moving picture theatre at an estimated cost of $11,000. 36 x 100, hollow tile and brick construction, stone and concrete foundation, felt and gravel roofing, gas and electric lighting, steam heating, maple and pine floors, seating.

Iona, C.B.
The Iona Gypsum Co., Ltd., have selected a site about a mile and a half from here on the shore of the Big Bras d'Or Lake and will shortly erect a plant, including mill, warehouse, mixing building and power house. The capacity will be about 1,400 barrels per diem.

London, Ont.
It is understood that A. J. May, 185½ Dundas street, is considering the possibilities of an artificial ice rink.

Plans are prepared for a garage and boiler room, for Hobbs Hardware Co., Richmond St. Manager, C. A. Whitham. Architects, McBride & Gilbert, Edge Block. One storey, 40 x 54, reinforced concrete construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating, concrete floors, fireproof doors, architectural iron railings.

Additions are proposed by the Home Bank of Canada, 394 Richmond St. Manager, W. J. Hill, and the architect, Vicar Munro, Bank of Toronto Bldg., will receive tenders until Jan. 3rd. 55 x 25, Indiana limestone and granite construction, stone foundation, felt and gravel roofing, electric lighting, oak and maple floors, plumbing, mosaic tiling, plate glass, cornices, bank fixtures.

Montreal, Que.
Workshop, Marcil, for O. Denault, 257 Clifton Ave. Two storeys, 25 x 70, concrete foundation, felt and gravel roofing. Permit issued.

P. G. Demetres, 559 St. James St., has purchased a site on Mt. Royal Ave. for the erection of a theatre and apartment house.

Two stores and flats, cost $8,000, Des Carriers, for J. P. A. Belanger, 2125 St. James. Architect, Chas. Bernier, 40 St. James. Three storeys, 50 x 50, concrete foundation, felt and gravel roofing. Plans in progress.

Niagara Falls, Ont.

Wm. Place, Morrison St., expects to start work March 1st on a dry goods store with offices and flats. Two stys., 50 x 90, concrete foundation, waterproofed, brick construction, patent roofing, store fronts and fixtures. The cost is estimated at $18,000.

Toronto, Ont.

Stores, apartments and garage, Church street, for J. M. Cowan (in trust), 65 Adelaide E. Three storeys, 36 x 120, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, steam heating, maple and birch floors, lime and sand plastering, plate and leaded glass, galvanized iron, mantels. Plans drawn.

Vancouver, B.C.

Cold storage warehouse, Water Street, for Vancouver-Prince Rupert Meat Co., 125 Hastings St. W. Architect, company's staff. Brick and mill or concrete construction. Plans being prepared.

CONTRACTS AWARDED

Montreal, Que.

Alterations to store, $5,500, St. Ambroise, for Dom. Textile Co., Ltd., 78 St. Ambroise. General contractor, C. E. Deakin, 41 Mayor St. 1½ storey, 75 x 50, concrete foundation, felt and gravel roofing.

Residences

Hamilton, Ont.

Residence, $12,000, Wentworth, for Adam Inch, Mount Hamilton. Architect, F. W. Warren, 808a Bank of Hamilton Bldg. Two storeys, basement and attic, 34 x 44, stone foundation, pressed brick construction. Work will not start until spring.

Residence, $9,000, planned by Architect, F. W. Warren, Bank of Hamilton Bldg. 2½ storeys, 46 x 32, stone foundation and construction. Work will not start until spring.

London, Ont.

Apartment house, Dundas St., cost $5,000, is contemplated by T. B. Escott, 566 Dundas St. Architect, A. Nutter, Dom. Bank Bldg., who will receive tenders. Two storeys, 40 x 62, red brick construction, concrete foundation, slate roofing, electric lighting, hot air heating, oak floors, plumbing, lime and sand plastering, mosaic tiling, one dumb waiter, skylights.

Montreal, Que.

Five flats, Iberville, for J. Thompson, 1169 Cartier, and J. Forbes, 535 Papineau ave. Three storeys, 25 x 41, concrete foundation, felt and gravel roofing. Permit issued.

Five flats, cost $4,000, Valois, for Toussaint Goudreault, 152 Forsythe. Three storeys, 25 x 51, concrete foundation, felt and gravel roofing. Permit issued.

Three flats, cost $5,000, for Emile Mitchell, 200 Berri. Three storeys, 25 x 42, concrete foundation, felt and gravel roofing. Permit issued.

Eight flats, $6,000, Poupart, for J. P. A. Belanger, 2125 St. James. Architect, Chas. Bernier, 70 St. James. Three stys., 60 x 30, concrete foundation, felt and gravel roofing. Plans in progress.

Six flats, St. Hubert, for N. Gariepy, 3613 Berri. Three storeys, 25 x 47, concrete foundation, felt and gravel roofing. Permit issued.

Six flats, St. Hubert, for V. Pelletier, 2684 Chateaubriand. Three storeys, 25 x 47, concrete foundation, felt and gravel roofing. Permit issued.

Three flats, Regina Ave., cost $9,000. Nap. Cousineau, 2580 Clarke. Three storeys, 25 x 72, concrete foundation, felt and gravel roofing. Permit issued.

Niagara Falls, Ont.

Day & Co., 418 Herkimer St., Hamilton, will start work as early in spring as possible on 130 residences at an estimated cost of $3,000 each. 2½ storeys, pressed brick construction, concrete block foundation, shingle roofing, gas and electric lighting, hot air heating, oak, pine, spruce and maple floors, plumbing, hard wall plastering, wood lath, mantels.

Toronto, Ont.

Four residences, $8,000, 8 Fort Rouille St. Owner, general contractor and carpenter, G. K. Halladay, 199 Dunn Ave. Two storeys, 60 x 42, brick construction. Tenders wanted for lath and plastering and wiring.

One detached residence for J. W. Lainsom, owner and general contractor, 262 Western Ave. Two storeys, 22 x 34, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One detached residence. Owner and general contractor, J. Bell, 185 Humberside Ave. 2½ storeys, 24 x 32, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One pair residences for J. H. Stanford (in trust), Bloor and Ossington. Architect, J. H. Stanford. Two storeys, 33 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels. Plans drawn.

One pair residences, $5,000, for W. H. Mallory (in trust), 31 Queen St. W. Architect, who is open to receive tenders. 2½ storeys, 34 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels.

One detached residence. Owner and general contractor, R. A. Shields, 121 Hilton ave. Two storeys, 22 x 35, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One pair residences, Kent road. Owner and general contractors, Hale & Corby, 333 Lippincott street. 2½ storeys, 33 x 40, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Six pair residences, $20,400, Laughton Ave. Owner and general contractor, Robt. M. Mackay, 72 Indian Rd. Cres. Mason and carpentry, day labor. Will let plastering, painting, heating, plumbing and electrical. 2½ storeys, 32 x 38, brick construction and foundation, shingle, felt and gravel roofing, electric lighting, hot air heating, oak and birch floors, lime and sand plastering, built-in fireplaces, mantels. Plans drawn.

Two detached residences, cost $5,000. Owner and general contractor, W. Williams, 20 Cloverdale Rd. Two storeys, 20 x 42, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

A. G. Strathy, 123 Simcoe street, will receive tenders for all trades for altering three residences on Cumberland street into apartments.

Geo. A. Brown, 37 Dorval Rd., is open for tenders (all trades) on 2 pair semi-detached residences. Two storeys, brick construction, shingle roofing, gas and electric lighting, hot air heating, lime and sand plastering, wood lath.

One pair residences, Rosemount, cost $5,000. Owner and general contractor, J. Edmonds, 71 Oakwood Ave. Owner superintends construction. Two storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Three residences, Morley Ave., for W. Wallace (in trust), 1 Dundee Ave. Tenders wanted for wiring, drains, tinsmithing and plastering.

W. T. Pearce, 838 Keele St., has just purchased corner Queen and Dunn building which he proposes remodelling into apartments.

One pair residences, Fulton, cost $5,000, for S. Robertson, 42 Fernbank Ave. Two storeys, 33 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built in furplaces, mantels. Plans drawn.

CONTRACTS AWARDED

Ottawa, Ont.

Residence for A. D. Helmer, 117 Bank St. General contractor, James Hutt, 381 Lisgar. Painting, F. W. Penny, Eastview. Additional contract awarded. Tenders still open on plastering, heating, plumbing and electrical. 2½ storeys, 35 x 22, brick veneer construction.

Residence. Owner and general contractor, C. D. Joyce, 1102 Somerset. Heating, J. R. Cameron, 488 Lewis. Plumbing, L. Gendron, Hull, Que. Two storeys, brick veneer construction. Additional contract awarded.

Residence, $4,500, for I. Villeneuve, 164 Bayswater Ave. Additional contract awarded. Electrical, C. C. Gould, 219 Florence.

Toronto, Ont.

One pair residences for W. F. Jifknes, 388 Clinton St. Architect, J. G. Hedges, 210 Clinton St. Mason, R. S. Scrimgeour, 170 Concord. Carpenter, H. G. Life, 110 Armstrong. 2½ storeys, 32 x 47, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels.

Tenders and For Sale Department

City of Ottawa, Dominion of Canada

Tenders for Steel Pipes

Sealed tenders in duplicate addressed one copy to the City Clerk, City of Ottawa, Canada, and the other to Sir Alex. Binnie Son & Deacon, St. Stephens House, Westminster, London, Eng., and endorsed "Tenders for Steel Pipes," will be received until 4 p.m. on **Tuesday, the 3rd day of February, 1914**, for about forty-two miles of steel pipe, fifty-four inches internal diameter, about thirty-two miles of steel pipe fifty-eight inches internal diameter, and about eleven miles of steel pipe, fifty-one inches internal diameter.

Forms of tender and specification may be obtained from Sir Alex. Binnie Son & Deacon, St. Stephens House, Victoria Embankment, London S.W., or from the City Engineer of Ottawa, Canada, on and after the fifteenth on receipt by them of a cheque to the value of five hundred dollars made out to the City Treasurer of the City of Ottawa, Canada, which sum will be returned on receipt of a bona fide tender.

The lowest or any tender is not necessarily accepted.

No tenders will be considered except from actual manufacturers capable of supplying the whole of the pipes within a period of two and a half years from the date of acceptance of the tender.

SIR ALEX. BINNIE SON & DEACON,
Engineers in Chief,
St. Stephens House,
Westminster, London, Eng.
Dated December 4th, 1914. 51-52-53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for bridge substructure and approaches at North Timiskaming, P.Q.," will be received at this office until 4 p.m. on **Monday, January 12, 1914**, for the construction of the substructure and approaches of a highway Bridge at North Timiskaming, County of Pontiac, P.Q.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont., Post Office, Montreal, and on application to the Postmaster at North Timiskaming, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 19, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—52858. 52-53

WANTED

A Small Thew Shovel.

Apply
Credit Forks Tile & Brick Co.,
262 Yonge St., Toronto.

53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for Addition to Refinery, Royal Mint, Ottawa, Ont.," will be received at this office until 4 p.m., on **Wednesday, January 14, 1914**, for the above mentioned addition.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C .DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47485. 53

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent. an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto. 53-12

STEAM PUMPS

Sales agents for Canada are wanted by one of the world's largest manufacturers of steam pumps. Only firms with high class connection will be considered. Apply Box 924, Contract Record, Toronto. 51-53

Representatives Wanted

Large firm manufacturing gravitation and pressure filters wants to secure reliable representatives for Canada. Successful installations in all parts of the world. Apply Box 923, Contract Record, Toronto. 51-53

Power Plants, Electricity and Telephones

Charlottetown, P.E.I.

The Maritime Trust Corporation, Halifax, N.S., has ordered entire new electric lighting and power plant from England, to be installed by next May.

Davidson, Sask.

By-law authorizing the installation of electric lighting and power plant, at a cost of $8,500, was passed by ratepayers

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FOR SALE

Steam Driven Air Compressors

thoroughly refitted

1-500′ Second Hand re-fitted Air Compressor, Compound Steam and Duplex Air Cylinder.
1-1200′ Re-fitted Air Compressor, Compound Steam, and two Stage Air Cylinders.

For particulars and prices write

The Jenckes Machine Company

SHERBROOKE, QUE. Limited
Montreal Office, - - - - - E. T. Bank Building

50-53

Dec. 19th. Owner, Town Council. Clerk, A. J. Robertson.

Ft. William, Ont.
The municipal council (Clerk, A. McNaughton), propose submitting by-laws to raise $238,000 for improving and extending railway system, and $90,000 for the purpose of improving and extending the municipal telephone system.

Ottawa, Ont.
City municipal electric department intend buying stoves, etc., and selling to citizens at cost. Chairman, Mayor J. A. Ellis. Engineer, Supt. Brown, City Hall.

Penetanguishene, Ont.
Electric line to run through Midland and connect with C. P. R. at Port McNicoll is under consideration by the Town Council. Ontario Hydro Power Commission will be asked for estimates and detail.

CONTRACTS AWARDED

Toronto, Ont.
Pump, etc., for high level pumping station required by Board of Control. General contractors, Can. Allis-Chalmers Co., King W. One 7½ and one 20 million gal. pump, at $29,835 and $29,355 respectively. General contractors, Turbine Equipment Co., Peterkin Bldg., Bay St., one 7½ and one 20 million gallon pump, at $26,500 and $26,500 respectively.

Boilers, etc., for pumping station, required by Board of Control. General contractors, Can. Allis-Chalmers Co., King W. Four boilers complete with superheaters, $18,695, steam piping complete, $2,840. General contractors, Jeffrey Mfg. Co., coal handling apparatus, $21,300.

Miscellaneous

Brantford, Ont.
Application has been made to Public Works Dept., Ottawa, for permission to lay gas pipe from Tilbury to London and Brantford.

Calgary, Alta.
Public School Board has approved the purchase of the following manual training equipment:—4 wood turning lathes, at $600; 1 motor generator, $150; cold metal work equipment, $50; printing outfit, estimated at $1,000; 1 oilstone grinder, $155; 2 safety switches, $16; one 36-inch band saw, motor driven, $370.65; 1 variety saw bench, with attachments, $218.57; one 5 h.p. motor, $65; one 6 h.p. motor, $98.62; one 1 h.p. motor, $51; installation estimated, $225. Sec., Mr. Brady, Mortlake Block.

Ft. William, Ont.
Ratepayers will vote on by-law to raise $10,000 for the purpose of establishing and equipping playgrounds. Clerk, A. McNaughton.

Galt, Ont.
A by-law is to be submitted to the ratepayers authorizing the expenditure of $15,000 for making permanent additions and improvements to the waterworks system.

London, Ont.
Isolated steam heating plant for three-storey warehouse, boiler pipes, etc., required by Hobbs Hardware Co., Richmond St. Manager, C. A. Whitwam. Architects, McBride & Gilbert, Edge Blk. Plans drawn.

Oshawa, Ont.
Tenders received by Dom. Govt. Dept. of Marine and Fisheries, Acting Deputy Minister, C. Stanton, Ottawa, until Jan. 12th, for removal of elevator and coal shed from Government reserve.

Winnipeg, Man.
Switching gear, cost $15,000, required by Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St. Switching gear and accessories for King St. sub-station. Specifications at office of Engineer. Tenders received by Board until Jan. 29th.

CONTRACTS AWARDED

Biggar, Sask.
Fire apparatus required by town council. Messrs. Dunlop Tire & Rubber Co., Ltd., Canada Bldg., Winnipeg, and Consolidated Rubber Co., awarded 500 ft. each of 2½-in. hose.

Toronto, Ont.
Fire hose required by Board of Control. General contractors, Dunlop Tire & Rubber Co., Booth Ave. 1,000 ft., 4-ply, 42 lbs. chemical engine hose, at 40c per ft.

Iron fence required by Board of Control. General contractors, Dyer Fence & Supply Co., Ltd., 645 King E. Fence on Beaty Blvd., King West, at $1.00 per lineal foot.

Canada Lumberman & Wood Worker

Contractors' Lumber

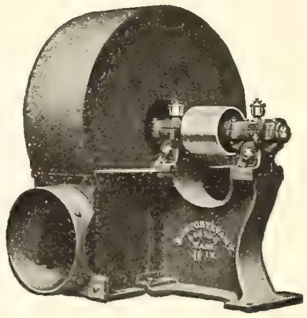
THE most natural place to find information concerning lumber and timber is in a lumber paper.

The "Canada Lumberman" has a special department which tells of odd lots of lumber that are on the market. If you knew of them could you not often save money by buying at a reduced price instead of paying yard prices?

Published on the 1st and 15th of each month. Subscription price $2.00 a year. Sample copy free. Write us.

Canada Lumberman
220 King St. West, - - - TORONTO

If You Are in the Market for a Fan, This Will Interest You



Geo. E. Nissen & Co., Winston,—Salem, N. C., writes that they have been using a STURTEVANT Blower in their smith shop for the past twenty years "without one minute of attention, only for oil."

Is it any wonder that when the abovementioned company needed additional fan equipment they wrote to the builders of the fan that gave them such service?

This is only one of hundreds of letters that we are continually receiving.

Sturtevant
(REG U S PAT. OFF.)
STOCK FANS

are built to give years of dependable service.

The Sturtevant Engineering Organization is fully conversant with fan applications.

If you have a problem that can be solved by a fan they will tell you how to solve it.

Write us asking for catalog and stating fully your requirements.

B. F. STURTEVANT CO. OF CANADA, LIMITED
GALT, ONTARIO
Eastern Sales Office: 919 New Birks Bldg., Montreal
Western Sales Office: J. A. McTaggert, & Co., Winnipeg, Man.

Business Notes

Aylmer, Ont.

Furniture store of Luther A. Ball, Talbot St., damaged by fire. Loss estimated at $4,000, covered by insurance.

Alvinston, Ont.

The warehouse of Percy Wills has been damaged by fire to the extent of about $5,000. Partly covered by insurance.

Berlin, Ont.

The tannery of Breithaupt Leather Co., 19 Queen St. N., was recently damaged by fire. The Leech House, bark mill, beam house, boiler and engine rooms being badly gutted. The loss is estimated at $70,000.

Carman, Man.

The implement warehouse and contents of Bridge & McCullough, Fournier Ave., has been totally destroyed by fire. Loss covered by insurance.

Montreal, Que.

The apartment house situated 147 Bishop St., owned by A. Giguere, 294 Park Lafontaine, has been destroyed by fire. Estimated loss $75,000.

The stone crusher building and machinery of MacKenzie, Mann & Co., Ltd., 411 Dorchester W., was destroyed by fire. Estimated loss $5,000. Company will purchase new electrical machinery at once.

Ottawa, Ont.

Stables of Magistrate O'Keefe, Queen St., destroyed by fire.

Sault Ste. Marie, Ont.

Vertical boiler and crane machinery of The Foundation Co., Ltd., Sussex St., destroyed by fire.

Oakville, Ont.

St. Judes Anglican Church has been damaged by fire to the extent of $4,000.

Parry Sound, Ont.

The factory of The Thompson Boat Works, with a number of gasoline launches were destroyed by fire.

Smithville, Ont.

Fire destroyed the stores occupied by E. & J. Morgan, grocers and general merchants, loss $8,000; Frank Hayes, jewellery and hardware, loss $25,000, will rebuild; Fred Joyner, barber, loss $3,000, equipment required; Lloyd Patterson, grocer, loss $2,000, public library and the furniture of the Masonic Lodge were also destroyed.

Toronto, Ont.

Simpson Ave. Methodist Church Sunday School badly damaged by fire, estimated loss $16,000. Partly covered by insurance. Pastor, Rev. E. E. Scott, 28 Simpson Ave.

New Companies

Fort George Citizens' Water Co., Ltd., has been incorporated with a capital of $25,000, with head office at Fort George, B.C., to carry on business as a power company and to supply water for domestic and other purposes, etc.

Maysmith and Lowe, Limited, has been incorporated with a capital of $10,000, with head office at Victoria, B.C., to carry on business as electrical and mechanical engineers and general contractors.

Metropolitan Electric Co., Ltd., has been incorporated with a capital of $10,000, with head office at Vancouver, B.C., to carry on business as an electric light company in all its branches.

National Stores, Limited, has been incorporated with a capital of $200,000, with head office at Vancouver, B.C., to carry on business as general contractors.

Ardley Lumber and Shingle Co., Ltd., has been incorporated with a capital of $15,000 with head office at Vancouver, B.C., to carry on business as manufacturers of lumber, shingles, etc.

Grandview Iron Works, Limited, has been incorporated with a capital of $25,000, with head office at Vancouver, B.C., to carry on business as ironfounders, manufacturers of agricultural machinery, implements, etc.

Electric Patents, Ltd., has been incorporated with a capital of $10,000, with head office at Vancouver, B.C., to carry on business as manufacturers of electric fittings, etc.

Vancouver Iron & Metal Co., Ltd., has been incorporated with a capital of $25,000, with head office at Vancouver, B.C., to carry on business as ironfounders, etc.

The Provincial Sand and Gravel Co., Ltd., has been incorporated with a capital of $100,000, with head office at Saskatoon, Sask.

American Titanic Iron Company, Ltd., has been incorporated with a capital of $1,000,000, with head office at Quebec, Que., to carry on business as iron and steel manufacturers. The provisional directors are S. N. Parent, barrister, of Ottawa, Ont.; E. Roberge, legislative councillor, of Lambton, Que.; N. T. Twigeon, manufacturer, of Beauseville, Que.; L. A. Cannon and G. Parent, barristers, of Quebec, Que.

Fraser & Chalmers of Canada, Limited, has been incorporated with a capital of $100,000, with head office at Montreal, Que., to carry on business as manufacturers of mining machinery, etc. The provisional directors are J. J. Creelman, G. S. Stairs and P. F. Casgrain, advocates, all of Montreal.

Russell Jennings Manufacturing Co., Ltd., has been incorporated with a capital of $50,000, with head office at St. Catharines, Ont., to carry on business as manufacturers of implements, machinery, etc. The provisional directors are A. L. Jennings, Chester, Conn., U.S.A., manufacturer; J. K. Kernahan and F. J. Graves, brokers and J. S. Campbell, barrister, of St. Catharines, Ont.

The Caughnawaga Light, Heat & Power Co., Ltd., has been incorporated with a capital of $50,000, with head office at Caughnawaga, Que., to carry on business as an electric light company in all its branches.

Beaver Coal and Power Co., Ltd., has been incorporated with a capital of $1,000,000, with head office at Montreal, Que., to carry on business as general contractors, etc. The provisional directors are F. H. Markey, K.C., W. W. Skinner, K.C., G. G. Hyde and G. Williamson, advocates, and R. C. Grant, accountant, all of Montreal, Que.

Louis Garbi, Limited, has been incorporated with a capital of $45,000, with head office at Montreal, Que., to carry on business as general contractors. The provisional directors are Louis Garbi, civil engineer, L. Gosselin, advocate, both of Montreal, Que., and L. Boyer, advocate, of Westmount, Que.

The Northern Canada & Peace River Development Co., Ltd., has been incorporated with a capital of $100,000, to carry on business as a general land and building company, with head office at Ottawa. The provisional directors are M. E. Arbey and O. H. Jaegar, journalists, J. E. Lesieur and J. B. Gourgon, clerks, and R. O. Dawson, accountant, all of Ottawa.

Windsor Properties, Limited, has been incorporated with a capital of $32,000, to carry on business as a general land and building company, with head office at Rodney, Ont. The provisional directors are W. N. Lusty, contractor, E. J. Schmid, jeweller, A C. Schleihauf, agent, and J. Kivell, all of Rodney, Ont., and H. W. Schweitzer, real estate dealer, of London, Ont.

The Hepworth Silica Pressed Brick Co., Ltd., has been incorporated with a capital of $125,000, to carry on business as brick manufacturers, etc., with head office at Hepworth, Ont. The provisional directors are J. Douglas and J. E. Campbell, manufacturers, and F. Campbell, physician, all of Hepworth, Ont., and L. Bloc, music dealer, and M. Forhan, gentleman, both of Owen Sound, Ont.

The Canadian Steel Studding and Manufacturing Co., Ltd., has been incorporated with a capital of $30,000, to carry on business as manufacturers of steel for building purposes, etc., with head office at Victoria, B.C.

Northwestern Construction Co., Ltd., has been incorporated with a capital of $25,000, with head office at Saskatoon, Sask.

Deer Park Land Co., Ltd., has been incorporated with a capital of $35,000, to carry on business as a general land and building company, with head office at Victoria, B.C.

The Credit Valley Stone Co., Ltd., has been incorporated with a capital of $250,000, to carry on business as operators of stone quarries, etc., with head office at Toronto. The provisional directors are R. A. Reid and H. R. Moses, barristers, both of Toronto.

Construction Supply Co., Ltd., has been incorporated with a capital of $60,000, to carry on business as general contractors, etc., with head office at Toronto. The provisional directors are W. Bain, bookkeeper, J. Ellis, J. J. Dashwood and R. Gowans, clerks, and J. S. Lovell, accountant, all of Toronto.

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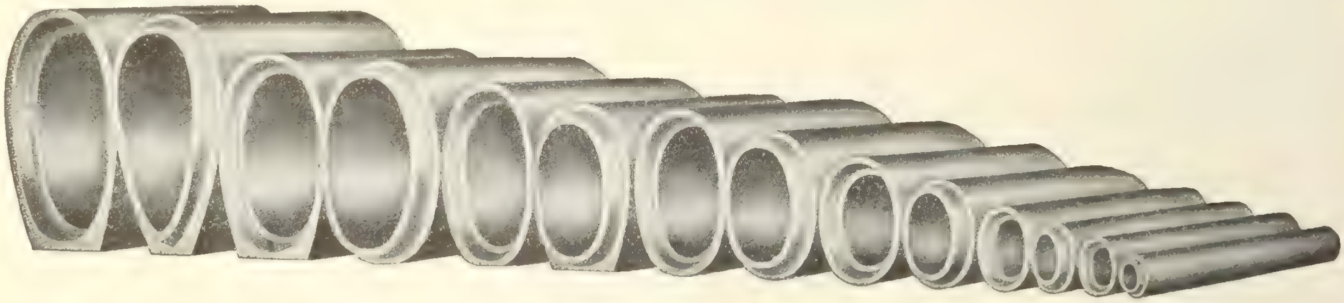

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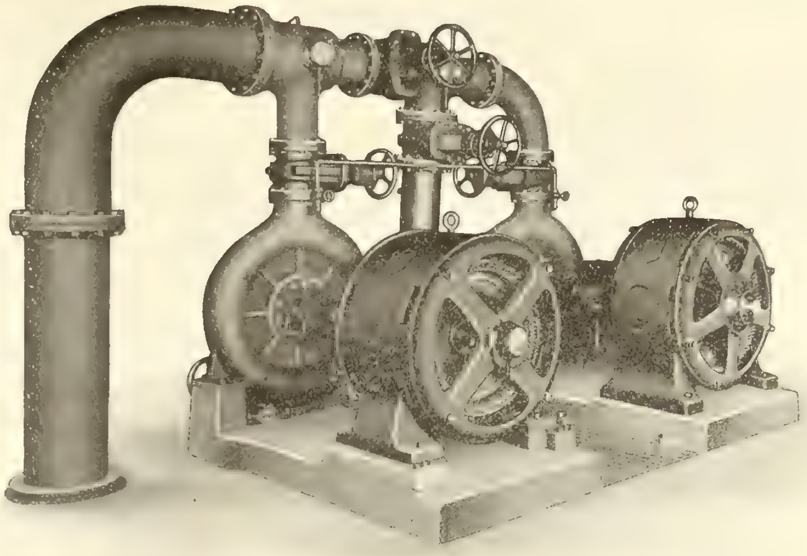

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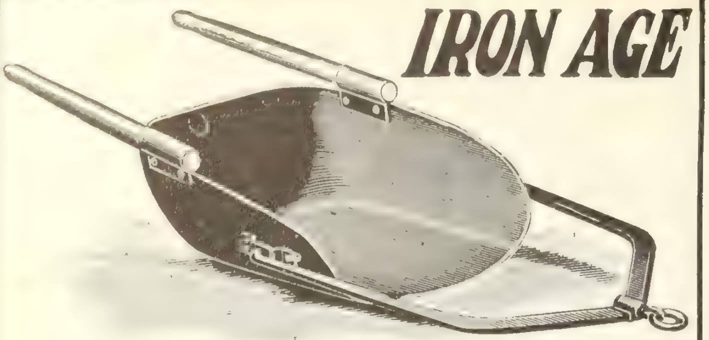

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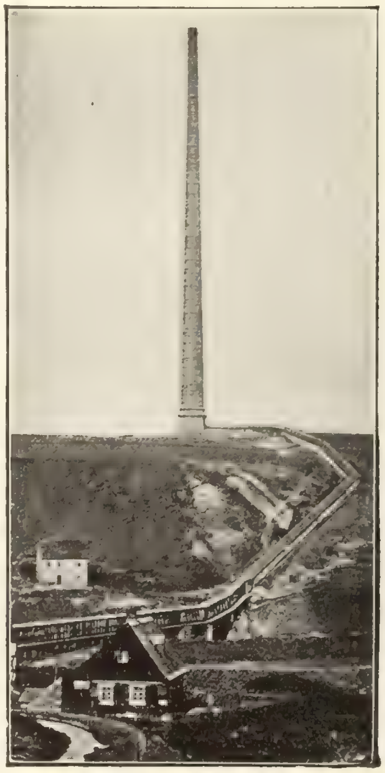

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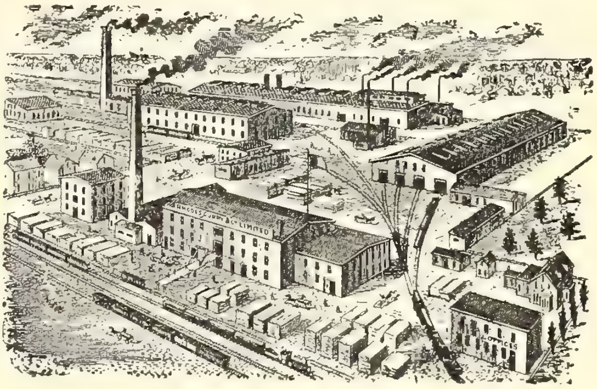

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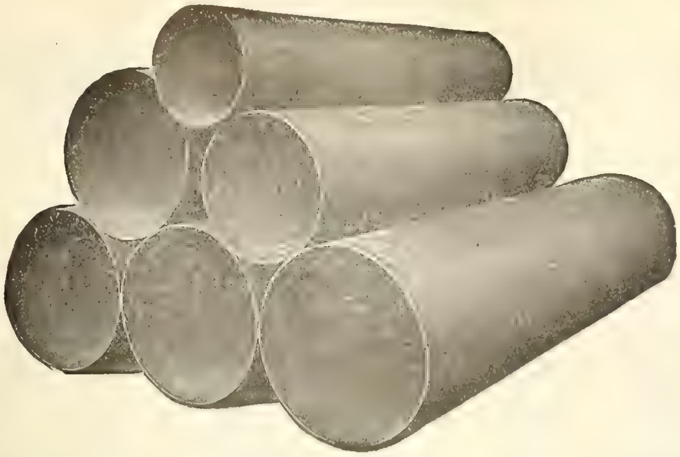

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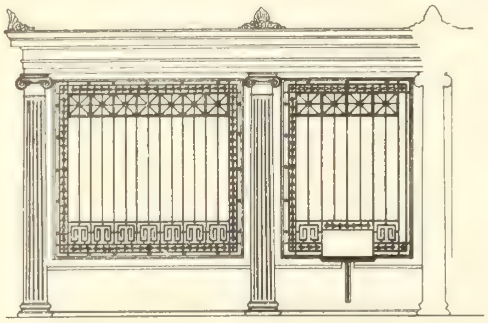

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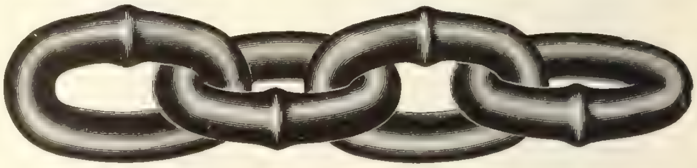

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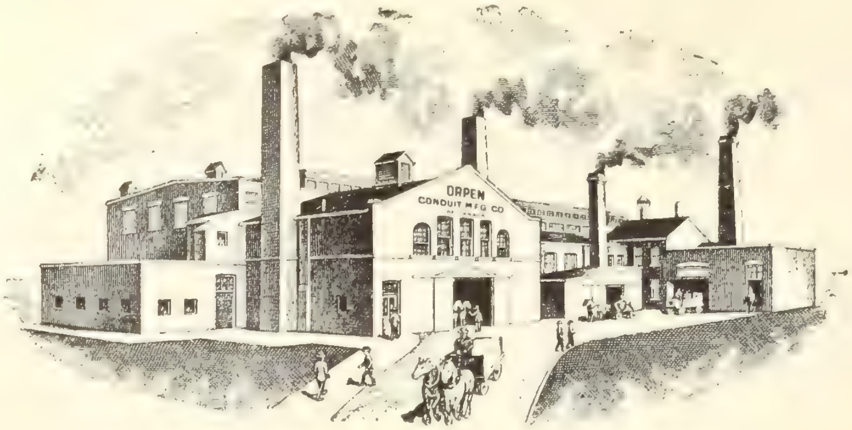

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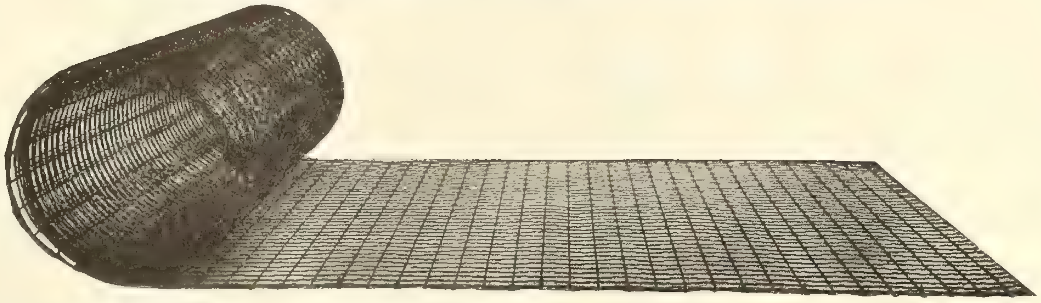

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GRAVEL stands third in the list of materials for concrete work according to tests made by the American Society of Civil Engineers; being surpassed only by Trap Rock and Granite.

GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

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GRAVEL goes farther and costs less to set up than concrete made of any other material.

If you are not aware of these facts, you should be, they mean much to you.

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Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

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3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

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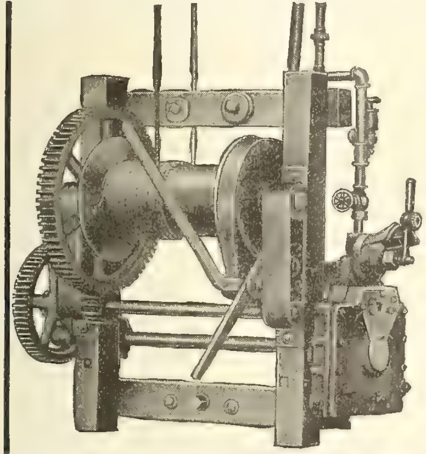
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.



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Single and Double Drum

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"Queenston Blue" Limestone
in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

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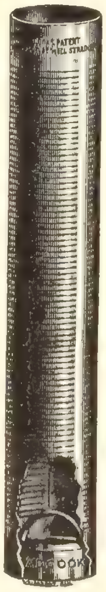
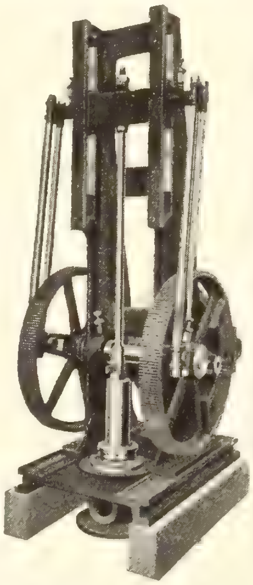


Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.



Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.

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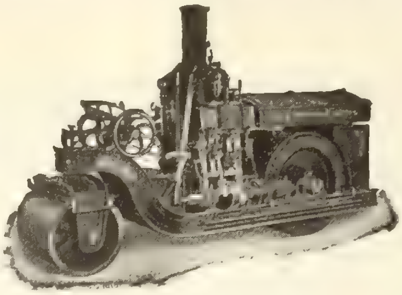

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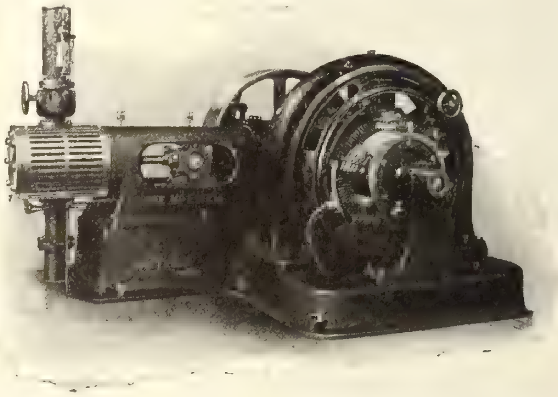

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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75
Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00
Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

		Star	D.D.
10 to 25	united inches	$4 25	$ 6 25
26 to 40	"	4 60	6 75
41 to 50	"	5 10	7 50
51 to 60	"	5 35	8 50
61 to 70	"	5 75	9 75
71 to 80	"	6 25	11 00
81 to 85	"	7 00	12 50
86 to 90	"		15 00
91 to 95	"		17 50
96 to 100	"		20 50
101 to 105	"		24 00
106 to 110	"		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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THE TEST OF YEARS IN THE SANITARY
AND ECONOMICAL DISPOSAL OF REFUSE
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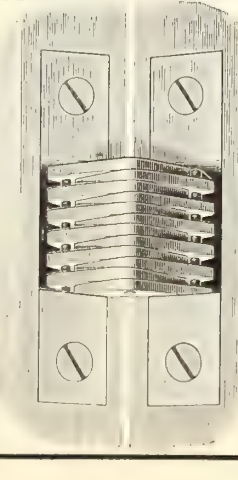

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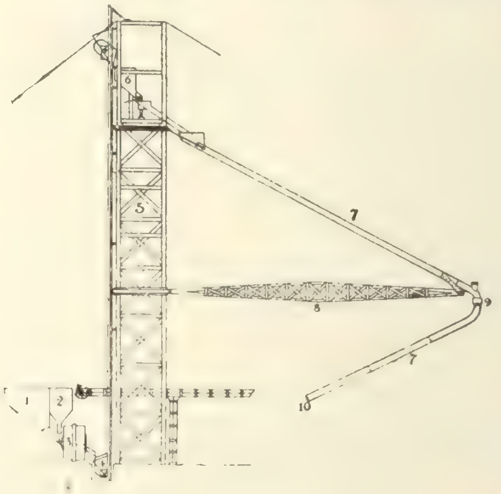

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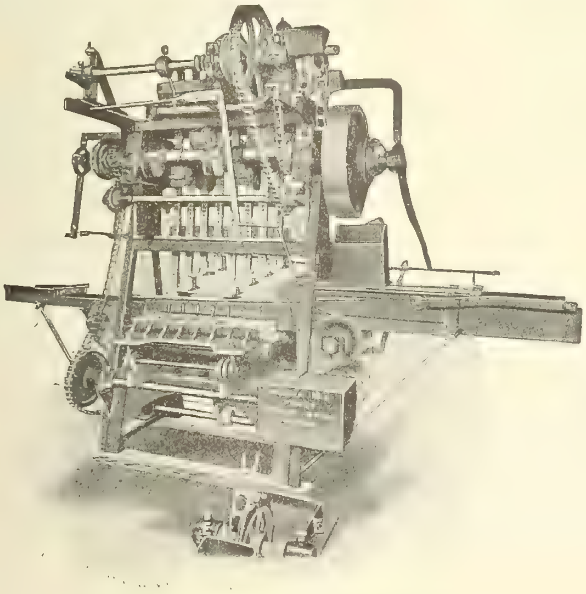
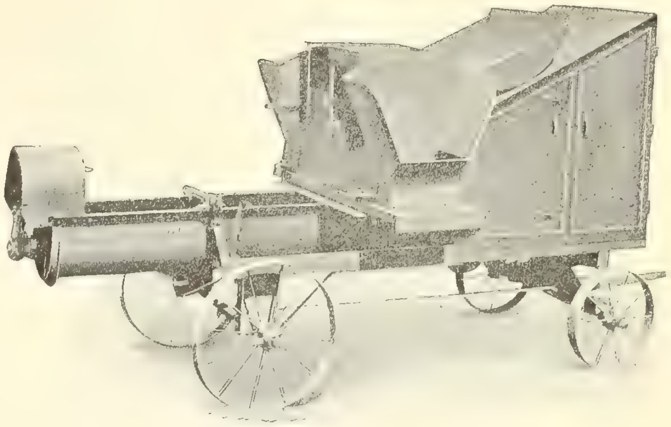


Besser Power Cement Brick Machine



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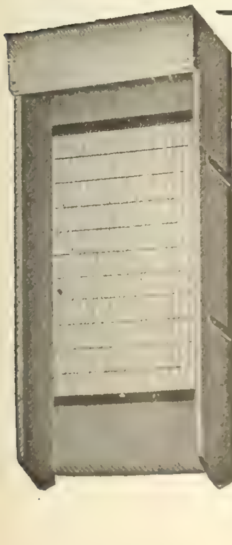

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Mill, Shop and Field Inspection of Steel Structures and Bridges.
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THIS IS THE FIFTH OF A SERIES OF DISCUSSIONS OF SIX VITAL POINTS DETERMINING THE SELECTION OF AN

AIR COMPRESSOR

THE WEARING QUALITY OF A COMPRESSOR DETERMINES WHETHER IT IS AN INVESTMENT OR AN EXPENSE.

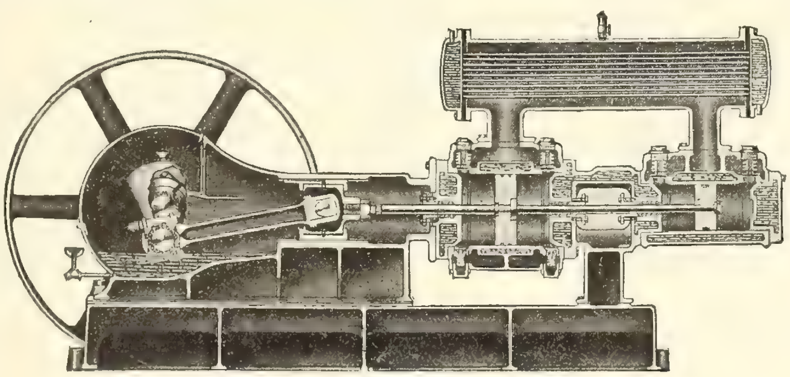
WEARING QUALITY

There was a time when manufacturers built their machines to sell—and cared not how they behaved afterward, how long they lasted.

Today, the best builders want their machines not only to please at the outset, but to go on pleasing indefinitely by their performance.

We designed and built Class "NE" and "NF" Compressors with this ideal. We intend them to be permanently profitable to the plant using them.

Continuous satisfactory performance, in a compressor, is a question of wearing quality. And this, in turn, depends upon the use of good materials in the proper way, and upon the proper safeguards against wear.



Sectional view of Class "NE-2" Compressor.
Note the "Bath" Lubrication, Water-Tube Intercooler and Water-Jacketed Cylinders.

"**NE**" and "**NF**" Compressors are built of the best materials the market affords, bought in quantities securing great price advantages. Many are made to our specifications; and all are tested before using.

Steels, of special quality, are given oil and heat treatments, increasing their strength and endurance. No other builder does this so thoroughly, or has such experience in it, or such facilities for it.

These designs represent the science of compressor construction in its highest form. There is ample strength and rigidity without extravagant weight or dimensions.

In "**NE**" and "**NF**" the friction (which is the wearing-out element of any machine) is minimized by liberal bearings, moderate bearing pressures and the positive "bath" lubrication which forbids a hot, tight, cutting bearing.

As a result of all this, the fine adjustments and careful fitting upon which high efficiency depends, are maintained indefinitely in a compressor which is proof against all but wilful neglect and abuse.

When you buy "NE" or "NF" Compressors, you are investing money where it will show long-time returns at a high rate. They have the wearing quality which makes them permanently profitable.

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Sydney Montreal Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

NORTHWESTERN ARCHITECTURAL TERRA-COTTA

Canadian Agents

Black Building Supply Co., Ltd., TORONTO

Reynolds-Wardell, Ltd., MONTREAL

W. T. Grose Co., WINNIPEG

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Smiley Company, EDMONTON, ALTA.

Whitlock-Ridell Co., MOOSE JAW SASK.

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Can. Pac. Rly. Building, Toronto, Can.
The Tallest Building in British Empire.

Architectural Terra-Cotta manufactured and supplied by

NORTHWESTERN TERRA-COTTA CO.
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General Steel Contractors

Large stock I Beams, Channels, Angles, Tees, Zees, and Plates always on hand.

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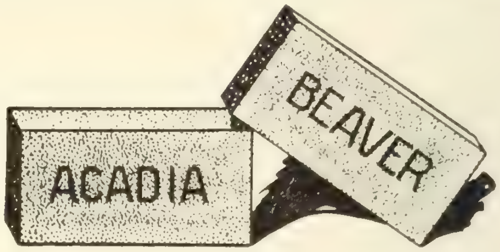
220 King St. West - Toronto, Canada



Shipments From Two Plants

Beaver pressed bricks are made at Pugwash works, and Acadia brand at Elmsdale works. Rail and water shipments can be made from Pugwash and rail shipments from Elmsdale.

These bricks are uniform in size, quality and appearance.

Prompt shipments always.

Nova Scotia Clay Works, Ltd.
HALIFAX - - NOVA SCOTIA

RED
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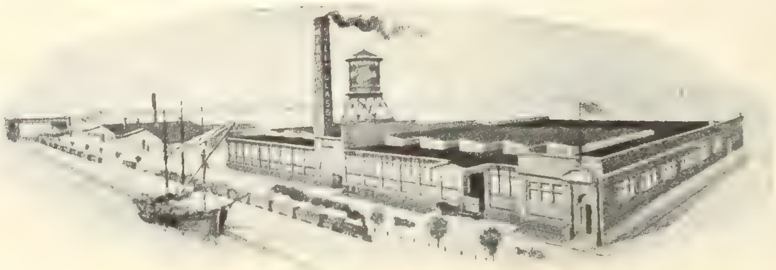

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BENDERS
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THE TORONTO PLATE GLASS IMPORTING COMPANY, LIMITED

Plate, Window, Figured, Stained, Wired, Bent, Mirror and Ornamental Glass

DON ROADWAY TORONTO

SIX REASONS

which account for the superiority of

Creosoted Wood Block Pavements

Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

Its Ease of Repair; No difficulty being experienced in removing and replacing the blocks; no expensive plant or skilled workmen required.

Its Sanitary Qualities; Creosote being a highly antiseptic and waterproofing material instantly destroys all germs, prevents the absorption of street filth and consequent decay.

Its Noiselessness; The rattle and bang of vehicles passing over its smooth surface absorbed and muffled till the quiet of the dirt road is obtained.

Its Dustlessness; Does not pulverize; the heaviest traffic only pounding down the wood fibres to offer the greater resistance.

Its Cleanliness; Having a smooth surface and being waterproof it does not differ in this respect from asphalt.

We manufacture blocks of the highest possible standard, the very best materials only being used and in the DOMINION WOOD BLOCKS we believe we produce an article that has no equal.

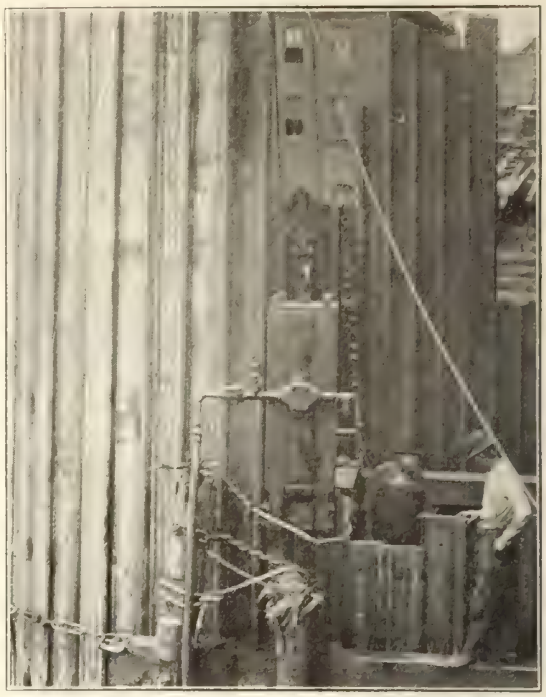
The Dominion Creosoting
Company, Limited
Vancouver, B. C.

McKIERNAN & TERRY

PILE HAMMERS

The heavy duty pile hammer here shown has been designed and built for driving heavy steel and wood sheet piling, concrete and wooden piles.

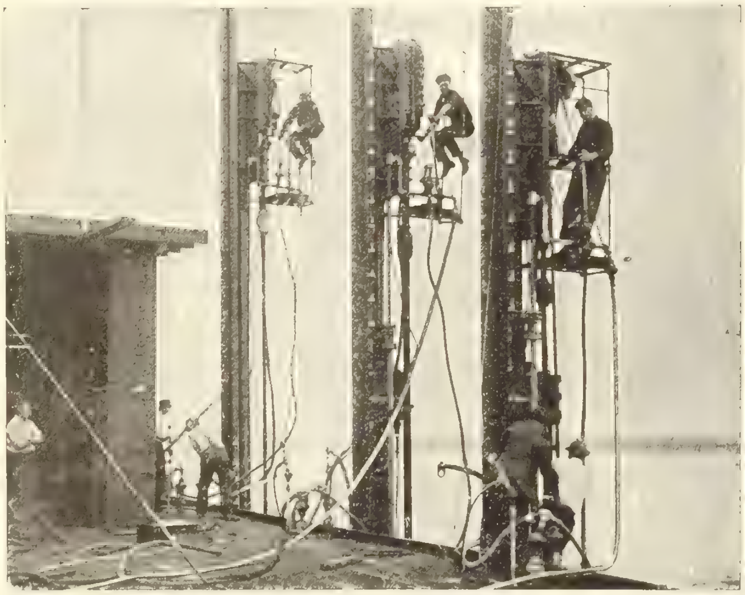
Apart from compact and sturdy construction, the simple and ingenious mechanism is worthy of note. No other pile hammer of the same weight strikes as many blows or has the effective energy behind the blow. The rapid stroke is attained by the use of the Accelerating Piston, a most valuable improvement in pile hammer construction, broadly protected by patents, and to be had only with hammers manufactured by this company. No other improvement has ever been applied to a steam or air driven pile hammer which has so greatly increased its piston speed and power of blow.



No. 7 Pile Hammer driving 12-inch heavy section interlocking steel sheet piling 35 ft. long through clay and hard pan for bridge foundation.

McKIERNAN & TERRY

CORLISS VALVE DRILLS



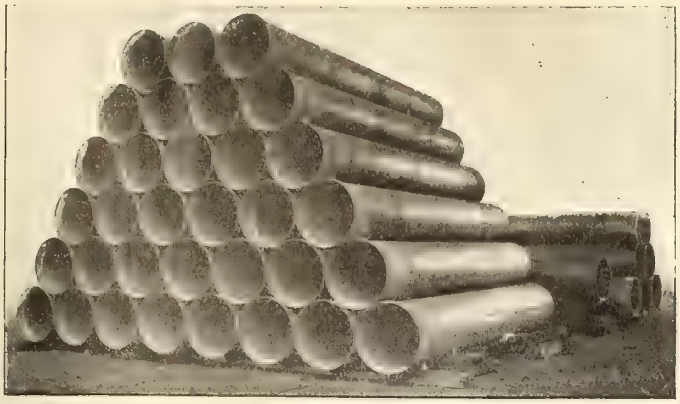
Corliss Submarine Drills with 7-inch cylinders, used for deepening river channel.

The Corliss Valve Drill is economical in power, strikes a quick and powerful blow and has a pullback of remarkable strength. It is as well adapted for use with air as it is for steam. When required to work with low steam pressure or "wet" steam, it shows greater superiority over all other drills and under such conditions, it operates with a degree of flexibility only expected of an air machine. The great power exerted on the return stroke adapts it for drilling in soft rock which forms a heavy sludge and does not "mud" freely, as well as for use in hard fitchering ground which tends to stick and bind the steel in the drill hole.

CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturer of Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines ,Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Shovels, Steam Turbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water Wheels.

HEAD OFFICE, TORONTO. **District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert**



STEEL PIPES
Welded or Rivetted

WITH ANY TYPE OF JOINT
AND FOR ALL PURPOSES

GAS, WATER, SEWAGE, STEAM, Etc.

Send for Prices

Thomas Piggott & Co., Ltd.

Cables:
"ATLAS, BIRMINGHAM"

BIRMINGHAM

Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs.

Careful attention to details and thorough workmanship have made Meadows' stair work popular.

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The GEO. B. MEADOWS

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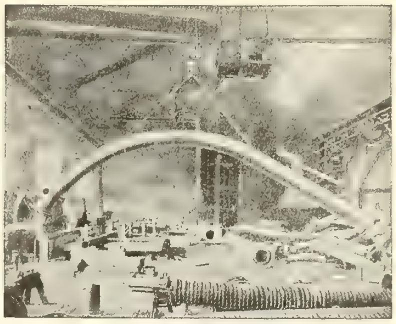

PIPE BENDS

eliminate heavy fittings
economize space,
avoid leaky joints,
save trouble, room and money

We make pipe bends in size and shape to meet your specifications. The cut above illustrates a 20 inch expansion bend of 16 foot radius containing 38 feet of pipe joined in the arc by the Atwood Line Weld.

PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION CO.
PITTSBURGH, PA.

ATWOOD **ENGINEERS FOUNDERS MACHINISTS** ATWOOD

"Bull Frog" Wheelbarrows—Scrapers and Concrete Carts

are strictly high grade. Are built to meet all requirements of the building trade.

The price is exceedingly low considering the quality.

THE LONDON CONCRETE MACHINERY CO.

of London, Ont., are the sole distributors for Canada. They carry a stock in their many branch ware-houses and agencies. *Write them* for *catalogue and quotations* at the nearest ware-house.

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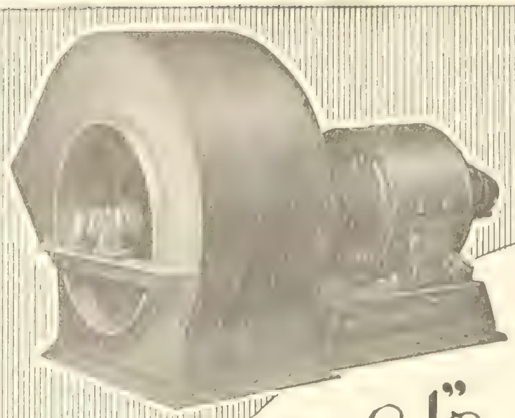
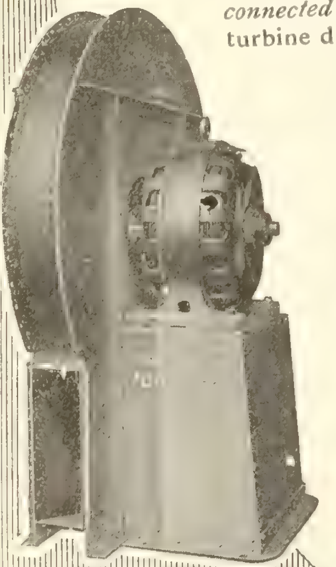


"Buffalo" Fans

For Heating, Ventilating, Drying and Exhausting.

Ask our engineers to recommend the fan best suited to your requirements. Our designs include the new high-efficiency "*Conoidal*" multiblade fan, used extensively for heating systems, mine and tunnel ventilation, and the motor-driven *Steel Plate Pressure Blower*, giving pressures up to 24 oz. Both of these designs show higher efficiency than obtained with any similar types. We specialize in *direct-connected* units (motor, engine or turbine driven) for every service. These are distinguished by absence of belt troubles and the very lowest power consumption. Whatever your problem write us.



CANADIAN BUFFALO FORGE CO., Limited
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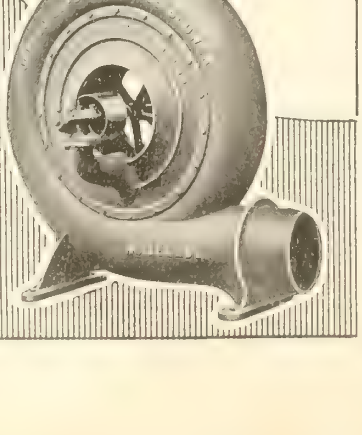

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A Color That is Liked

The walls of the new office building of a well-known business concern in the United States were rising rapidly, but the head of the company did not like the color of the brick, so he ordered the walls torn down and a more pleasing color of RED Brick used.

Few concerns can afford to tear walls down in order to secure a pleasing RED. That is all the more reason why care should be used in the selection of the brick before it is ordered.

"BRADFORD PRESSED BRICK"

(Trade Mark Reg. U.S. Pat. Office)

has a distinctive, pleasing, red that appeals to the most exacting judge of color.

We make brick of just one color —**Red "Bradford Reds"**—both dry pressed and wire cut impervious—a smooth facing brick for all uses. Color absolutely uniform, because carefully sorted.

"Bradford Ruffs"—the famous Bradford Red Color in a rough brick for unusual effects.

Send for the "RED" Catalog.

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"The Red Brick People"
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